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January 27, 2017

Will Lauwers
Director, Emerging Technology
Department of Energy Resources
Storage.DOER@massmail.state.ma.us

Re: Joint Massachusetts Distribution Company Comments on DOER Energy Storage Targets

Dear Mr. Lauwers:

On December 27, 2016, the Massachusetts Department of Energy Resources ("DOER") determined that establishing energy storage system targets by July 1, 2017 is prudent for the Commonwealth of Massachusetts. This determination was communicated to the Massachusetts Legislature (the "Legislature") pursuant to "An Act Relative to Energy Diversity" ("the Act").[1] St. 2016, c. 188, § 15. As noted by the DOER in its December 27, 2017 letter to the Legislature, the Act allows the DOER to consider, "...a variety of policies to encourage the cost-effective deployment of energy storage system..." (Letter at 1). Pursuant to that authority, the DOER opened a public comment period seeking feedback on the "appropriate target scale, structure, and mechanisms" for energy storage systems (id.).

Fitchburg Gas and Electric Light Company d/b/a Unitil ("Unitil"), Massachusetts Electric Company and Nantucket Electric Company, each d/b/a National Grid ("National Grid"), NSTAR Electric Company and Western Massachusetts Electric Company, each d/b/a Eversource Energy ("Eversource") (collectively, the "Distribution Companies") are pleased to offer the following comments in response to the DOER's request. In summary, the Distribution Companies support

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[1] Section 15(a) of the Act states:

> On or before December 31, 2016, the department of energy resources shall determine whether to set appropriate targets for electric companies to procure viable and cost-effective energy storage systems to be achieved by January 1, 2020. As part of this decision, the department may consider a variety of policies to encourage the cost-effective deployment of energy storage systems, including the refinement of existing procurement methods to properly value energy storage systems, the use of alternative compliance payments to develop pilot programs and the use of energy efficiency funds under section 19 of chapter 25 of the General Laws if the department determines that the energy storage system installed at a customer's premises provides sustainable peak load reductions on either the electric or gas distribution systems and is otherwise consistent with section 11G of chapter 25A of the General Laws.

the establishment of aspirational targets (i.e., targets that establish goals, without penalty) that are both reasonable and achievable, given the nascent, yet accelerating, development of energy storage technology.

As noted by the Distribution Companies in comments to the DOER submitted on December 13, 2016 (the "EDC Comments"), aspirational targets for the Distribution Companies will enable exploration and innovation in the development, operation, financing, and cost recovery used to develop energy storage projects, and will aid in identifying the most valuable applications of this technology. Just as importantly, an aspirational target will provide for sufficient flexibility in determining the best locations on the electric distribution network. Experience gained by the Distribution Companies from these initial commitments will lead to a more optimal deployment of energy storage systems in the future, which will help the Distribution Companies, other stakeholders, and customers in Massachusetts.

The viability of implementing energy storage is contingent on exploring use cases to stack benefits which may include: (1) energy cost reduction; (2) reduced peak capacity; (3) ancillary services provision and/or cost reduction; (4) wholesale market cost reduction; (5) avoidance of more costly distribution and transmission upgrade alternatives to meet customer reliability needs; and (6) integrating distributed renewable generation.

As a start to that exploration, Eversource has identified and is evaluating at least four energy storage projects. Each project is premised on a varying combination of applications that would permit Eversource to mix the benefit streams obtained from each project. These various benefit streams have the potential to improve reliability and power quality, provide ancillary services, enhance the integration of distributed generation, and potential to reduce energy and capacity costs. Eversource is continuing to evaluate the structure and commercial models that will be relied upon to implement each of the projects. In addition, Eversource is currently proposing to conduct certain energy storage demonstration projects to reduce peak demand.

National Grid is exploring potential transmission and distribution ("T&D") sites that could benefit from energy storage by integrating storage at these locations to possibly reduce the need to replace or upgrade assets as a non-wires alternative, increase grid reliability, and provide capacity relief. National Grid looks forward to developing additional use cases with multiple stacked benefits in demonstration/pilot projects, which will be critical in defining the overall value to customers before scaling deployment. Currently, National Grid is in the process of interconnecting three energy storage systems that it owns, and has received approval by the Department of Public Utilities ("DPU") from its Solar Phase 3 filing to procure up to an additional 7 MW of energy storage systems to be installed at targeted locations on its distribution system during 2017. National Grid is also actively exploring the inclusion of energy storage systems in incentive programs, such as Energy Efficiency or Demand Response, where appropriate. National Grid believes energy storage systems may provide potential benefits to the

distribution system and further development will continue to enhance the Distribution Companies' knowledge about the value and role of these important technologies.

Unitil is also exploring the best potential use for energy storage on its system. While the Company has no definitive plans or demonstration projects under consideration at this time, there are two locations associated with distribution substations where energy storage may be beneficial. The first of these would explore the use of energy storage to defer a substation expansion in the Townsend area. The second would be in conjunction with one of the larger solar installations presently under construction and proximate to a major substation. Unitil will continue to evaluate these and other opportunities as storage technologies evolve.

These demonstration projects either have been approved, or will ultimately be subject to approval, by the DPU.

- **Recommendations for Target Scale, Structure and Mechanisms to Achieve**

  - *Target Scale*

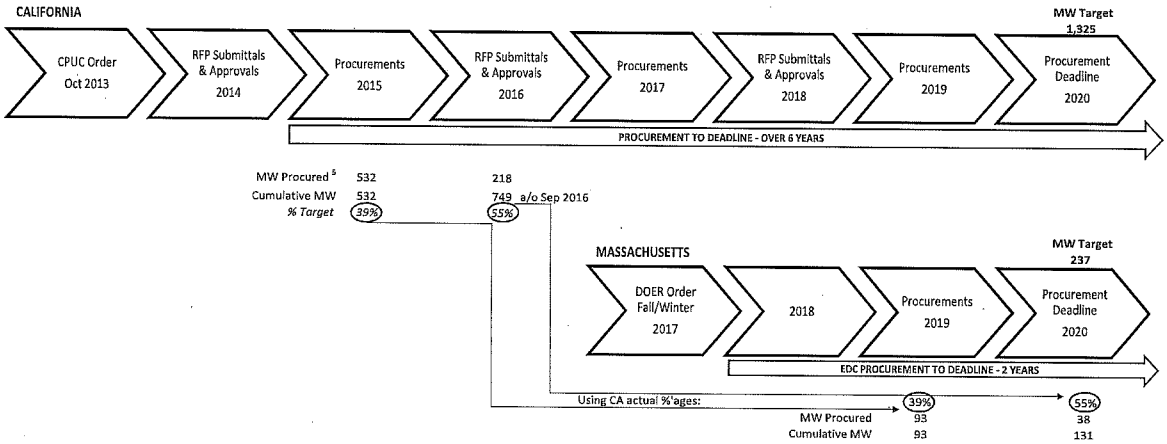
The Distribution Companies seek to establish targets that create a balance such that the amount of proposed target megawatt ("MW") or megawatt-hour ("MWh") of storage procured by the Distribution Companies is ambitious but also reasonably achievable by January 1, 2020. By January 1, 2020, the Distribution Companies propose the scale of the target to be a combined 200MW/500 MWh, under a weighting proposal as further described below. Achievement of this target would be demonstrated by the quantity of energy storage under written commitment (such as an approved purchase contract), by January 1, 2020, pursuant to either the MW or MWh target. Such a target would put the Distribution Companies well on a path to achieve a state-wide aspirational energy storage target of 600MW and/or 1,500 MWh of procured storage by 2025.

Storage applications vary on their duration requirements with some requiring short duration charge/discharge cycles (power applications) while others requiring long duration charge/discharge cycles (energy applications). It is difficult to say which applications are likely to be economic in the near term and therefore it is difficult to project an average duration for a storage target. While today power applications are generally more economic than energy applications, continued cost declines in storage technologies may make more energy applications economic in the long term.

In the spirit of setting an aspirational target, we propose to create a combined MW/MWh target. The target could be achieved through projects that the Distribution Companies can choose to apply toward either the MW measure or the MWh measure. This would give the Distribution Companies the flexibility to achieve the goal through applications and technologies that are the most viable and cost-effective. By way of example, the 200 MW/500 MWh aspirational target recommended by the Distribution Companies could be measured as follows:

Project Portfolio Example	MW	MWh	Measurement Class(MW or MWh)	% of target achieved
Power/MW Projects	100	50	MW	100/200 = 50%
Energy/MWh Projects	50	250	MWh	250/500=50%
Total Achievement				50%+50% = 100%

The aspirational target proposed by the Distribution Companies, once adjusted for differences in the market size and economy of Massachusetts, is greater than the aggressive energy storage target implemented in California. In 2013, California imposed an energy storage mandate equal to 1,325 MWs by 2020 or roughly 2% of peak load[2]. Applying the same level of peak load to Massachusetts would result in an energy storage target of approximately 237 MW based on projected 2020 peak load[3]. This assumes a time period for meeting the Massachusetts target that is approximately 4 years shorter than the period for compliance in California (as seen in the graphic below).[4]



Using the California target as applied to the size of the Massachusetts market and adjusted for the differences in the time period for obtaining the target would result in a 131 MW

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2 California Energy Demand 2014-2024 Final Forecast, Volume 1,Table ES-1, page 3.

3 ISO New England 2016 Forecast Data File, tab 3.

4 More to the point of achieving the deployment of energy storage, even less, has actually reached commercial operations in California during this time period.

5 California Energy Storage Alliance: California Energy Storage Market Update, September 21, 2016, page 24.

procurement target for the Distribution Companies, or approximately 69 MWs less than the EDC procurement target proposed by the Distribution Companies. This increment reflects the additional learnings from the California energy storage projects and other energy storage projects around the country. Although this is an ambitious but reasonably achievable energy storage target, there is a concern that any target above this level will likely be unachievable within the time period specified by the legislation.

In establishing an aspirational target, the Distribution Companies respectfully suggest the DOER to consider the expected cost of future energy storage projects. Using the information contained in the DOER's *State of the Charge* report, the cost of meeting the aspirational target today is approximately 60% higher than is expected in 2020. While the proposed target is ambitious, going beyond this level will further increase costs for Massachusetts customers by moving too quickly to deploy energy storage prior to the technology reaching maturity.

► *Target Structure*

The Act created the framework for setting a procurement target for the Distribution Companies to procure "viable and cost-effective energy storage systems". To qualify under the Act an energy storage system must reduce greenhouse gas emissions, cut demand for peak electrical generation, avoid new investment in generation, transmission or distribution assets, or improve the reliability of the distribution grid. The procurement processes conducted by the Distribution Companies will identify the appropriate energy storage systems that provide benefits for customers. The procurements will allow for both ownership by the Distribution Companies and third party ownership ("TPO") models.

Given that the energy storage market is still in its infancy, especially with respect to operating experience and development processes, obstacles to widespread deployment in Massachusetts exist that must be recognized by stakeholders. Accordingly, the Commonwealth should define the achievement of any target based on whether a storage project has been committed to by the Distribution Companies, without differentiating between behind-the-meter ('BTM") or front-of-the-meter ("FTM") resources.

Such targets should allow for flexibility and innovation in the deployment of energy storage. A rigid allocation between BTM and FTM applications should not be made. The DOER is encouraged to let the economics and markets determine how much, and where, storage is deployed. For FTM storage, the Distribution Companies will work with storage vendors/suppliers to identify the best solution for customers and go through a competitive process to select the most cost-effective, safe, and reliable systems. In addition, the Distribution Companies will develop and propose mechanisms for financial support of third-party and end-customer owned BTM storage systems that are controlled/dispatched by Distribution Companies as part of meeting the overall target. The Distribution Companies also welcome opportunities to work with storage vendors/developers on innovative business models that take into account the

flexibility of storage systems and their ability to serve multiple applications. The Distribution Companies see innovation within the energy storage industry as a key opportunity for future deployment and urge caution in a target structure that could stifle business models that do not clearly fall into a single category.

Energy storage systems will interact with electric company systems in multiple ways, both from BTM and FTM, and will interact on both the distribution and transmission systems. As such, on an operational level, it is critical that the Distribution Companies have the option to establish dispatch control or operational parameters of storage resources. Indeed, allowing the utilities the ability to dispatch BTM systems in particular (irrespective of their ownership) will enable the realization of system benefits that would otherwise not be accessible. For instance, a BTM energy storage system absent dispatch control from the Distribution Companies would be limited to managing on-site demand charges, providing transmission level demand response, on-site back-up, and other customer services, and potentially shifting the cost of existing T&D capacity to customers that lack energy storage. Such an installation would not be useful for deferring future distribution capacity investments, improving the voltage stability of the distribution system or potentially resource adequacy. The Distribution Companies are in the unique position of having to ensure that varying voltage and load requirements are operated reliably. They must be able to quickly dispatch energy in response to immediate changes in demand (which can be significant due to storm outages) or a voltage drop or surge. This is distinct from certain forms of distributed generation such as solar that are currently passive assets that either produce power or do not without intervention or involvement from the Distribution Companies. In contrast, an energy storage system must respond to dispatch instructions to provide value to the distribution networks. Although such dispatch instructions may be automated to simplify operations, the proper instructions at the right time are still necessary to ensure value to customers.

The Distribution Companies urge the DOER to consider not limiting the means by which the Distribution Companies may achieve energy storage targets. In addition, the Commonwealth should not cap the amount of storage that may be owned by any stakeholder, including the Distribution Companies. Indeed, the Act imposes no limits on the amount of energy storage that may be procured by the Distribution Companies or any other party.[6] In fact, any storage system owned, developed and/or procured by the Distribution Companies should be counted toward any target established by the DOER.

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[6] The Distribution Companies do not oppose allowing municipal light departments to opt-out of procuring energy storage, at their discretion.

► *Target Mechanisms*[7]

In many cases, new energy storage investments will be incremental to existing Distribution Company capital investment plans and will have a variety of avenues for capital investment and cost recovery. Some amount of storage may be made as a substitute for system upgrades or replacements that would otherwise occur (e.g., the non-wires alternative noted above) within current capital budgets; some may be incentivized by demand response program grants; some may occur through utility-owed solar programs and some may occur through energy efficiency efforts, for example.

The Distribution Companies also acknowledge a possible new avenue to achieve energy storage targets currently being discussed by the DOER and interested stakeholders though the next solar incentive program. For those projects that fall into that program, the Distribution Companies support having such projects count toward the Commonwealth's energy storage targets. The DOER is encouraged to consider additional options, including broadening its Alternative Portfolio Standard ("APS") to include more energy storage technologies to provide additional avenues to count storage toward the Commonwealth's clean energy policy goals. This would be consistent with a model for evaluating the costs and benefits of energy storage that allows the Distribution Companies to stack benefits or income streams and net them against the underlying cost of the procured storage system or service, therefore reducing the cost to customers.

Other funding mechanisms may include a tariff offering, which would include some form of remuneration or performance incentive for the system benefits created by non-Distribution Company owned systems. They may also include an additional investment tracker in distribution rates, collected from all customers, for utility-owned storage either FTM or BTM, to be proposed to the DPU to accelerate the goals of the Commonwealth while maintaining other investments needed to provide safe and reliable service to customers.

Additionally, there are several areas where enhancements to existing regulatory mechanisms and market rules may be necessary to allow for the recognition or monetization of certain benefits and for stacking of multiple benefits. For example, the New England ISO is encouraged to consider revising market rules to enable energy storage systems to participate in the wholesale market and be appropriately compensated for the benefits provided in the energy, capacity and ancillary services markets. Rules may also need to be clarified to allow T&D assets to participate in the wholesale market while receiving cost-based recovery. Additionally, an expedited regulatory process to review and approve proposed projects/programs is encouraged to

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[7] The term "mechanisms" was not defined by the DOER in its December 27, 2017 communication to the Legislature. For purposes of these comments, the Distribution Companies interpret this term as meaning the means by which the Distribution Companies may achieve DOER's storage targets over time.

allow Distribution Companies the ability to achieve the proposed target within the expected timeframe.

- **Conclusion**

The Distribution Companies support an aspirational energy storage procurement target, coupled with policy support from DOER as a means of increasing beneficial deployment of energy storage within the Commonwealth. The Distribution Companies look forward to continuing to participate in the development of the energy storage target. If you have any questions about this input, please contact any of the undersigned.

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January 27, 2017

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Judith F. Judson, Commissioner
Department of Energy Resources
100 Cambridge Street
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RE: An Act Relative to Energy Diversity, Chapter 188 of the Acts of 2016 (the "Act"): Establishment of Energy Storage Targets

Dear Commissioner Judson:

The Municipal Electric Association of Massachusetts ("MEAM") submits the following comments with respect to the above-referenced matter. MEAM is a statewide association of all 40 municipal light departments in the Commonwealth of Massachusetts. For the following reasons, municipal light plants should not be required to meet energy storage targets.

1. The express language of the Act indicates that energy storage targets should not apply to municipal light plants ("MLPs").

The Act makes no reference to MLPs.

Section 15(a) of the Act references "electric companies" not MLPs. The Act includes amendments to G.L.c. 164, §1, none of which make MLPs subject to energy storage targets.

The Legislature's silence on a subject cannot be ignored. *Roberts v. Enter. Rent-A-Car Co. of Boston*, 438 Mass. 187, 193, (2002). If the Legislature had intended for MLPs to be subject to energy storage targets, it would have made such amendments. *Souza v. Registrar of Motor Vehicles*, 462 Mass. 227, 232 (2012).

Statutory construction ascertains the true intent of the Legislature from the words used. *Simmons v. Clerk-Magistrate of Boston Div. of Hous. Court Dep't*, 448 Mass. 57, 64–65, (2006). Words will not be added to a specific statute that the Legislature did not put there, either by inadvertent omission or by design. *Id.* (citations omitted). Where the Legislature has employed specific language in one portion of a statute, but not in another, the language will not be implied where it is absent. *Id. citing, Beeler v. Downey,* 387 Mass. 609, 616, 442 N.E.2d 19 (1982); *First Nat'l Bank v. Judge Baker Guidance Ctr.,* 13 Mass. App. Ct. 144, 153, 431 N.E.2d 243 (1982).

Thus, the express language of the Act demonstrates that MLPs are not subject to energy storage targets.

2. MLPs are not electric companies.

Chapter 164's definition of "electric company" does not include MLPs.

Massachusetts General Laws, Chapter 164, §1, defines "electric company" in pertinent part as:

> a corporation organized under the laws of the commonwealth for the purpose of making by means of water power, steam power or otherwise and for selling, transmitting, distributing, transmitting and selling, or distributing and selling, electricity within the commonwealth ... G.L. c. 164, §1

While an MLP may make, sell or distribute electricity, it is not an "electric company" under G.L. c. 164. MLPs are not corporations. Pursuant to Chapter 164, MLPs are established by the votes of the citizens of the cities or towns in which they operate. G.L. c. 164, §§35, 36.

As opposed to being established pursuant to Chapter 164, electric companies are corporations which are organized or chartered pursuant to applicable general or special laws. Chapter 164 applies to them and their officers and stockholders. G.L. c. 164, §3. On the other hand, MLPs, specifically pursuant to G.L. c. 164, §2, may be construed as included in the terms "corporation" and "electric company" only with regard to certain provisions of Chapter 164 regarding meters and termination of service, and not in any other provisions therefor. G.L. c. 164, §2.

Although the Legislature specifically included MLPs as electric companies with respect to meters and termination of service, it did not do so with respect to storage. Had the Legislature wanted MLPs to be construed as electric companies with respect to storage, it could have done so. The fact that it did not demonstrates the Legislature's intent that MLPs are not electric companies for purposes of storage. Therefore, there is no statutory support for MLPs to be included in regulations requiring "electric companies" to meet energy storage targets.

3. The Act does not provide DOER with authority to require MLPS meet energy storage targets.

No provision of the Act specifically bestows upon DOER the authority to require MLPs meet energy storage targets. The lack of language expressly providing DOER with such authority clearly shows the Legislature's intention to withhold such authority from DOER.

A statute must be interpreted as enacted. *Harris v. Town of Wayland,* 16 Mass. App. Ct. 583, 585 (1983). MLPs are not expressly referenced in the Act. The absence of a reference to MLPs clearly demonstrates that the Legislature did not intend to require MLPs meet energy storage targets. *American Honda Motor Co., Inc. v. Bernardi's, Inc.,* 432 Mass. 425, 430 (2000).

Where the statute's meaning is clear and unambiguous, the Legislature's expressed intent must be given effect. *Providence & Worcester R.R. Co. v. Energy Facilities Siting Bd.,* 453 Mass. 135, 141 (2009). An incorrect interpretation of a statute by an administrative agency is not entitled to deference. *Id.*

In interpreting a statute, effect and purpose should be given to all of its words, for "[b]arrenness of accomplishment is not lightly to be imputed to the legislative branch of the government." *Id.*, citing, *Adamowicz v. Ipswich,* 395 Mass. 757, 760, 481 N.E.2d 1368 (1985), quoting *Selectmen of Topsfield v. State Racing Comm'n,* 324 Mass. 309, 314, 86 N.E.2d 65 (1949). Where the statutory meaning is unambiguous it must be followed, unless "following the Legislature's literal command would lead to an absurd result, or one contrary to the Legislature's manifest intention." *Id., citing White v. Boston,* 428 Mass. 250, 253, 700 N.E.2d 526 (1998).

Under the plain terms of the Act, DOER has no authority to require MLPs meet energy storage targets. *See Greater Boston Real Estate Board v. Board of Registration of Real Estate Brokers and Salesmen,* 405 Mass.360, 363-64 (1989); *Telles v. Comm'r. of Insurance,* 410 Mass. 560, 562-63 (1991). An implication of authority cannot arise where there are such very definite markers of the Legislature's intention to withhold such authority. *Life Insurance Association of Massachusetts v. Commissioner of Insurance,* 403 Mass. 410, 418 (1988).

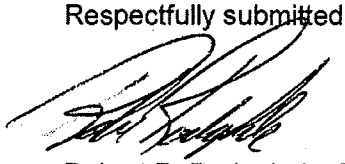
4. Interpreting the Act as bestowing DOER with the power to require MLPs meet energy storage targets would be unreasonable.

Unreasonable statutory interpretations cannot stand. *Franklin Office Park Realty Corp. v. Commissioner of the Department of Environmental Protection,* 466 Mass. 454, 460 (2013). The Legislature has traditionally refrained from imposing on MLPs the statutory and regulatory obligations applicable to investor-owned regulated utilities. *E.g.* G.L.c. 164, §§ 57, 58 (MLPs exempt from the requirement of procuring DPU approval of their rates and power purchase contracts); G.L.c. 164, §47A (MLPs exempt from competitive choice of generation supply), G.L. c.25A, §§ 11F(i) (MLPs exempt from RPS obligations).

DOER must presume that the Legislature did not intend to work such a radical change from its historic treatment of MLPs as would occur if MLPs are required to meet energy storage targets, without plain and unequivocal language to that effect. *Roberts v. Enterprise Rent-A-Car Boston,* 438 Mass. 187, 193 (2002). "A matter may be within the letter of a statute and not come within its spirit,...if to include it would require a radical change in established public policy or in the existing law and the act does not manifest any intent that such a change should be effected." *Suffolk Construction,* 449 Mass. at 458, *quoting Commissioner of Corps. And Taxation v. Dalton*, 304 Mass. 147, 150 (1939).

If DOER interprets the Act as bestowing upon it the power to regulate MLPs, such an interpretation would require "a radical change in established public policy [and] the existing law and the act does not manifest any intent that such a change should be effected." *Id.* It follows that such an interpretation of the Act would be unreasonable.

Respectfully submitted on behalf of MEAM



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January 27, 2017

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Via electronic mail to Storage.DOER@massmail.state.ma.us

Comments of the New England Power Generators Association, Inc. on the Adoption of Storage Targets

I. Introduction

The New England Power Generators Association, Inc. (NEPGA) appreciates the opportunity to submit comments[1] in response to the Department of Energy Resource's (DOER) letter soliciting stakeholder input on energy storage targets. NEPGA is the trade association representing competitive power generators in New England. NEPGA's member companies represent approximately 26,000 megawatts (MW), or roughly 80% of the installed capacity in New England. NEPGA's mission is to support competitive wholesale electricity markets in New England. We believe that open markets guided by stable public policies are the best means to provide reliable and competitively-priced electricity for consumers. A sensible, market-based approach furthers economic development, jobs and balanced environmental policy for the region.

The recent decision by DOER to adopt storage targets as authorized by newly-enacted legislation, *An Act Relative to Energy Diversity*, will affect NEPGA members. Accordingly, NEPGA offers these comments on key issues for DOER's consideration. To facilitate review of the stakeholder comments, NEPGA offers limited responses at this time, but may desire to submit additional comments in response to comments filed by other organizations.

[1] The comments expressed herein represent those of NEPGA as an organization, but not necessarily those of any particular member.

II. Setting Appropriate Storage Targets

NEPGA supports the development and deployment of innovative energy resources, including storage technology. Major investments and innovations have taken place thanks to the open marketplace that allows any resource that can compete, to do so. It is with that in mind, that NEPGA opposes the subsidization or carving out of markets for individual resources or technologies that undermine the overall marketplace that support tens of billions of dollars of energy supply investments here in Massachusetts and across New England. To the degree Massachusetts decides to provide out-of-market support for storage technologies in the hopes of spurring further deployment, NEPGA believes such development should be approached in a prudent and deliberate manner. A helpful model here can be found in the development of Class I renewable technologies under the Commonwealth's Renewable Portfolio Standards ("RPS").

As with the RPS goals, starting with a smaller targeted amount allows a newly emerging technology the opportunity to develop to the point where it can transition to then compete on equal footing with more cost-effective technologies in the marketplace. Accordingly, NEPGA encourages DOER to set modest initial storage targets to allow these resources time to become cost-effective and thus allow for larger application of these technologies (scalability). Proceeding in this manner not only appropriately supports the goal of incenting the development of new technologies, but it does so without picking winners and losers at the expense of the competitive marketplace, and it does so without burdening consumers with those increased costs.

This is particularly important in light of the substantial increase in public policy-funded resources that are today being proposed for Massachusetts consumers outside of the well-functioning wholesale market. These include 9.45 TWh of "clean energy resources" and up to 1,600 MW of offshore wind alone that are authorized in the same recent energy legislation that spurred this proceeding. In addition, the Department of Environmental Protection is considering draft regulations limiting the emissions, and, therefore, production, of Massachusetts power plants as well as mandating a Clean Energy Standard for retail providers. All these policies are expected to add substantially to what have often been cited as some of the highest retail electricity rates in the United States, despite the fact that wholesale electricity prices have fallen by over 50% since 2005.[2] NEPGA urges DOER to be mindful of

[2] In 2005 ISO-NE wholesale electricity prices averaged $76.64 MWh dropping to $41 MWh in 2015. Source: : https://www.iso-ne.com/static-

the totality of public policy costs relative to energy that consumers are asked to shoulder and the impacts that these dramatic intrusions into a well-functioning marketplace will have on costs, reliability and future necessary infrastructure investments.

Moreover, proceeding in a more deliberate manner will also allow DOER to consider and benefit from similar efforts relative to storage that are occurring at the wholesale level.[3] These combined efforts provide substantial opportunities for storage technologies to participate in the competitive marketplace and encourage increased deployment, in-line with the policy laid out in the *Act*. With additional information and insight gained from these wholesale market changes, DOER can then augment its targets later, if appropriate.

III. Conclusion

In conclusion, NEPGA continues to support the development and integration of new technologies into the market. NEPGA also, however, supports protection of the competitive market and supports technological solutions that are capable of competing with other existing resources within the market. NEPGA also supports state policies that allow for the competitive markets to function without undue interference, and policies that do not pick winners and losers within that marketplace. Accordingly, for the reasons set forth more fully above, NEPGA urges the DOER to proceed with setting moderate, incremental targets that will allow for the development of new technologies without undue disruption to the competitive market.

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assets/documents/2016/03/20160329_prelim_2015_prices_release.pdf. Although audited year-end data from 2016 is not yet available, it is expected that 2016 average wholesale electricity prices were less than $40 MWh. In fact, eight of the ten lowest wholesale electricity price months since 2003 occurred in 2015 or 2016.

[3] The Federal Energy Regulatory Commission recently issued a Notice of Proposed Rulemaking ("NOPR"), which if promulgated will require each RTO/ISO to, *inter alia*, develop or confirm the existence of "participation models" that fully accommodate the participation of energy storage resources in wholesale capacity, energy and ancillary service markets. *Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*, 157 FERC ¶ 61,121, Docket Nos. RM16-23-000 and AD16-20-000 (published Nov. 17, 2016). Earlier this year, ISO-NE (and all other ISOs/RTOs) responded to a Commission request for information on whether any barriers existed to the participation of energy storage resources in ISO-NE's wholesale markets in the same proceeding under which the Commission issued the NOPR. ISO-NE unequivocally stated that new and existing energy storage resources have every opportunity to enter and participate in ISO-NE's wholesale markets, and that it continues to evaluate the wholesale markets for improvements. *See* Letter Requesting ISO New England Inc. to File a Response to the Data Request of May 2, 2016, Regarding Electric Storage Participation in Regions With Organized Wholesale Electric Markets, Docket No. AD16-20-000 (April 11, 2016); Response of ISO New England Inc., Docket No. AD16-20-000 (filed May 16, 2016). Indeed, in the most recent Forward Capacity Auction large battery storage resources cleared for the first time.

Edison Electric
INSTITUTE

Power by Association

Comments of the Edison Electric Institute
Massachusetts Department of Energy Resources Storage Target Proposal

January 27, 2017

The Edison Electric Institute (EEI) respectfully submits these comments to the Massachusetts Department of Energy and Resources (DOER) regarding the recently passed An Act Relative to Energy Diversity, Chapter 188 of the Acts of 2016 (Energy Diversity Act). EEI and its members, which include three Massachusetts utilities, Eversource, National Grid, and Unitil, appreciate this additional opportunity to share a national perspective on factors that are promoting the rapid growth of energy storage.

EEI is the association that represents all U.S. investor-owned electric companies, international affiliates and industry associates worldwide. Our members provide electricity for 220 million Americans, operate in all 50 states and the District of Columbia, and directly employ more than 500,000 workers. With more than $100 billion in annual capital expenditures, the electric power industry is responsible for millions of additional jobs. Reliable, affordable and sustainable electricity powers the economy and enhances the lives of all Americans. Our members include local distribution and transmission companies across the country that are already investing in, and operating, energy storage devices across their systems.

In just a few short years, energy storage technologies have evolved from being marginal grid resources to key transmission, distribution, and generation alternatives that are expected to continue to experience rapid growth. As an option to enhance the power system and provide customer benefits, energy storage is a technology that the electric power sector can harness to support essential reliability services, provide flexibility in energy and capacity functions, as well as other services such as load following, peak load reduction and emergency back-up.

As interest in storage increases, and policies and regulations are being created or refined across the country, it is important to keep a few ideas in mind to ensure that the deployment of energy storage contributes to enhancing the reliability and resiliency of the power system for the benefit of consumers. Given the continued increase in variable renewable energy resources and the North American Electric Reliability Corporation (NERC) observed changes in the provision of essential reliability services,[1] it is critical that the relevant policies, standards and rules provide an appropriate path for utilization of these versatile devices.

DOER's energy storage targets should be voluntary, reasonable and achievable.

As discussed in our December 16, 2016, comments, EEI agrees with DOER that energy storage is a game changing resource with the potential to help the grid become more reliable, flexible, and resilient. Electric power companies throughout the country are investing in new technologies, including energy storage, to deliver the benefits of a smarter energy infrastructure to customers. Given the continued advancements in storage technology, the industry recognizes that it has the potential to be a significant part of the solution to many of today's energy challenges. In fact, the electric power industry already uses more than 90 percent of all energy storage in the country and has deployed over 90 percent of all the energy storage developed since 2013.[2] However, if the deployment of energy storage is not thought out carefully, it could just as easily become part of the problem adding unnecessary costs, redundancies and idle capacity to the system.

It is important that any target that is set by DOER is voluntary, reasonable, and achievable within the timeframe specified. The goal should be to kick start deployment, helping Massachusetts stakeholders gain important practical experience to facilitate the deployment of technically viable and cost effective energy storage. For that to happen, even if aspirational, any target needs to be achievable. The level of the target and the timeframe to achieve it are of the utmost importance. Given how complex the distribution system is and the added complexity that the deployment of distributed energy resources (DERs) is adding to it, it is critically important that

[1] NERC, *Essential Reliability Services Task Force – Measures Framework Report*, November 2015.
[2] U.S. Department of Energy, *Storage Database*, accessed on August2016, including projects from 2013 to mid-August 2016.

enough time is given for the electric distribution companies (EDCs) and other stakeholders to deploy new energy storage resources in a planned and coherent way that maximizes their value to the system. The goal should be successful and meaningful deployment, not just deployment.

Also, given how rapidly energy storage technologies are evolving, it is important to allow enough time to take maximum advantage of continued cost declines and technical improvements, as well as of the deployment of other technologies, like smart meters and sensors, that can contribute to maximizing and broadening the benefits of storage resources. Careful consideration of timeframes may also need to include the time to modify some existing rules and regulations that are important to the successful integration of energy storage devices. For instance, both the Federal Energy Regulatory Commission (FERC) and ISO New England are looking into modifying or creating new rules that will affect the way energy storage is used and integrated, which, in turn, will impact its cost-effectiveness and value, and hence, the efficacy of the target.[3]

When it comes to resources that can directly impact the reliability of our electric grid, volume and speed of deployment should not be the guiding principles of their expansion, instead, any sound policy should allow for and promote careful planning that takes into account need, location, technical capabilities, new and existing rules, and cost to consumers. It is critically important to ensure that the deployment of energy storage contributes to enhancing the reliability and resiliency of the system for the benefit of all consumers.

The DOER storage program should explicitly allow electric distribution company participation and ownership of energy storage while providing an opportunity for cost recovery.

In Massachusetts, and other states with deregulated retail electricity markets, one of the potential market barriers facing large scale deployment of energy storage has traditionally been the inability of EDCs to own and operate generation assets. Energy storage is often misclassified as a just "generation asset," even though it can provide generation, transmission and distribution

[3] *See* Federal Energy Regulatory Commission Notice of Proposed Rulemaking on Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators, 15 FERC ¶61, 121 (Nov. 17, 2016).

type services. As a result, EDCs are sometimes inappropriately precluded from owning and operating energy storage even when the primary function of that resource would be distribution related. EDCs across your state are in a distinct position to positively leverage the proposed storage program in order to gain vital new experience and information on how to best integrate storage to enhance the reliability and resiliency of the distribution grid. Allowing these companies to own and operate energy storage (a very important resource to improve the reliability, flexibility, and resiliency of the grid), with a clear path for cost recovery, will be a crucial step in continuing to achieve these goals in a cost effective manner while also helping the Commonwealth achieve its goals of increasing reliability, reducing greenhouse gas emissions, and accelerating the deployment of distributed energy resources.

For example, EDCs are currently in the best position to be able to identify the most valuable applications and the optimal locations on the grid. When it comes to the deployment of DERs, including energy storage, location matters. The same resource can help or hurt the reliability and resiliency of the grid depending upon where it is located – by alleviating or enhancing congestion, for example. This is not only important for reliability, but it also has a direct impact on costs as new technologies have the potential to defer or reduce the need for incremental investments or, on the contrary, require additional investments in new capacity or distribution upgrades.

At the end of the day, electric power companies are uniquely positioned to continue to promote a variety of advanced technologies, including storage, due to their broad geographic reach, direct interaction with customers, experience with system optimization, experiences in deploying energy efficiency and demand response, and expertise in integrating distributed renewable energy resources. As operators of these systems, electric power companies employ advanced technologies to reduce outages by anticipating challenges and taking steps to resolve them before they create reliability problems. Also, as critical infrastructure owners and operators, they are vested in supporting the highest level of cybersecurity. As EDCs continue to make investments in energy storage and other smarter energy infrastructure, the importance of security and resilience will increase. Modern technologies bring many benefits, but also introduce new vulnerabilities that may threaten the reliability of the energy grid. The EDCs are uniquely

equipped with both the expertise and experience in mitigating the risks introduced by new technologies and evolving threats.

Any final energy storage target should maintain a focus on flexibility.

Experience shows that when developing a policy that aims to promote a certain type of technology, like renewable portfolio standards for instance, allowing flexibility reduces costs and improves operational and technical efficiencies. Energy storage, in particular, is itself a very flexible technology, so it is best to let the operators of the grid and the energy storage industry drive the development of these technologies based on existing and future technical performance of the devices, need and uses, regulations, and cost. Overly-prescriptive rules are unnecessary and can stifle the deployment of the best technologies and forgo the possibility to maximize their benefits over time. Allowing as much flexibility as possible in the rules and mechanisms of the target would guarantee that the same dynamism that characterizes the storage technologies and market translates into their deployment path.

For those reasons, it would be better to use both MW and MWh as metrics for the target since it will be difficult to define ahead of time how energy storage devices will be used or how the new rules that FERC and ISO New England are working on will interact with their daily operations. For the same reasons, differentiating targets for behind the meter (BTM) applications and front of meter applications (FTM) will do nothing but add unnecessary rigidity to the deployment of energy storage. Depending on the technology, their cost and the rules in place, the best solution for customers could be either BTM or FTM and both options should remain available.

The EDCs in Massachusetts have already shown their commitment to the deployment of clean energy and of energy storage, as well as to maintaining reliability and meeting consumer needs. They have pledged to work with third parties and consumers to deploy and incent BTM applications that they control and can use to enhance the reliability of the grid, maximize their value, and gain experience so as to facilitate the future deployment of increasing amounts of storage resources. For the same reasons, instituting caps on certain types of ownership would go against the purpose of the program, which includes gaining experience on the best types of

devices for particular needs, their operational characteristics, and on improving the knowledge of how these devices help contribute to the overall reliability and resiliency of the electric power grid.

Any DOER policy on storage should seek to ensure that it is deployed in a safe, reliable and cost-effective manner.

As DOER thinks about how best to deploy and integrate energy storage through a multitude of programs and policies, EEI continues to urge the Department's careful and thoughtful consideration of the following general principles:

- Deployment of energy storage should be done in a safe, secure, reliable and cost-effective manner that recognizes the benefits of the storage device, including reliability benefits, whether in front of or behind the meter.
- All distribution companies should have the ability to make investments in energy storage systems regardless of regulatory model.
- Whether owned by distribution companies, customers or third parties, when deployed in the distribution system, energy storage deployment should follow the same guidelines as all other similarly situated resources:
    - Ensure that energy storage systems are connected safely.
    - Ensure fair, economically viable compensation of services, which will depend on regulatory framework and market design.
    - Ensure that retail ratemaking that avoids undue cost-shifting to consumers that do not own storage devices.
    - Enable full participation by distribution companies in the ownership and/or operation of distributed storage as determined by the distribution company and to support its business model, including maximizing the visibility and control of distributed storage by distribution companies.
    - Encourage optimal location and other technical specifications when possible to increase the value that distributed storage provides to the distribution system.

- Ensure, for planning and operating purposes, visibility by distribution companies, impact assessment and some level of utility input/control into the energy storage resources that are connected to the distribution system. Encourage appropriate coordination between the transmission and distribution systems (and federal and state regulators) to the extent that distributed storage will impact the transmission system.

Conclusion

At the end of the day, energy storage should be encouraged to develop in a context that promotes cost-effective deployment benefiting all electricity customers. While each state faces its own unique challenges, all should share this goal. Under that guiding principle, EEI strongly encourages DOER to establish reasonable, achievable, voluntary targets designed to drive utility investment, adoption, and ownership in a cost effective manner, by maximizing flexibility in their implementation.

Respectfully submitted,

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January 27, 2017

Judith F. Judson, Commissioner
Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

Re: Massachusetts Energy Storage Initiative

Dear Commissioner Judson:

Pursuant to your December 27, 2016 letter, the Office of the Attorney General ("AGO") is pleased to provide comments to the Department of Energy Resources ("DOER") on the development of policies that encourage the cost-effective deployment of energy storage in the Commonwealth.

As discussed further below, the AGO suggests that DOER phase its development and implementation of storage targets. As an initial step, the AGO recommends that DOER (1) adopt a small scale energy storage procurement target using reasonable pilot projects administered through the Department of Public Utilities and DOER; and (2) initiate a parallel stakeholder process to develop statewide standards for valuing and evaluating the need for energy storage systems. Adopting this approach is consistent with the Act to Promote Energy Diversity's ("Act"), 2020 implementation deadline and the statutory requirement to re-evaluate the target not less than every three years. The AGO suggests that DOER use this three-year period to lay the groundwork for future energy storage initiatives.

I. Electric Company-Ownership is Only One of the Many Possible Applications for Energy Storage

Pursuant to the Act, DOER determined that it is prudent to adopt energy storage procurement targets for electric companies. In determining the appropriate target for electric companies, DOER should recognize and account for the many opportunities for energy storage ownership, funding, and application beyond electric company-owned energy storage. Electric company-owned energy storage is only one part of the "energy storage picture" in Massachusetts. In its State of Charge Study ("Study" or "State of Charge"), DOER states that in order to maximize the benefits of storage and encourage energy storage deployment, the Commonwealth should explore and encourage all possible use cases for energy storage.[1] Stakeholder comments submitted to the DOER in December 2016 also support energy storage ownership and deployment scenarios beyond electric company-owned energy storage funded by electric ratepayers. Diversifying the funding models, ownership, and application of energy storage will encourage more rapid adoption and decrease the burden on Massachusetts electricity ratepayers.

II. DOER Should Establish a Limited Target for 2020

The AGO is supportive of establishing electric company-owned storage procurement targets. To allow better data and understanding of the extent to which the benefits of energy storage to the Massachusetts grid and to ratepayers can be quantified or realized, the AGO recommends that DOER set a limited procurement target designed to promote a small number of reasonable pilot projects for the target period of July 1, 2017 to January 1, 2020.

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[1] Department of Energy Resources, State of Charge (2016) [hereinafter Study or State of Charge], *available at* http://www.mass.gov/eea/docs/doer/state-of-charge-report.pdf, p. XV.

The pilot project approach will provide insight into best practices, and provide electric companies with the opportunity to perform testing, evaluations, and to gather data. Testing and evaluations should improve the electric companies' understanding and quantification of the benefits and costs of using energy storage for use in potential future, larger scale deployment of energy storage.

Several other factors speak to the prudence of limiting the scale of the 2020 procurement target. First, the statutory timeline for compliance is short. From the date the targets are set, the electric companies will have only two and half years to design, propose, obtain approval for and construct energy storage projects. Second, due in part to the fact that Massachusetts has yet to modernize its electric grid, electric companies and other stakeholders currently do not have an adequate understanding of system needs to maximize the technological and cost effectiveness of a more extensive roll out of electric company-owned energy storage systems. Stakeholders responding to DOER's March 2016 survey listed "identify[ing], value[ing], and increase[ing] data availability on locational benefits and constraints" as one of the top priorities to adopting energy storage in Massachusetts.[2] Third, as identified in DOER's Study, there are several barriers to recognizing the full value of energy storage in Massachusetts; for example the lack of market rules clarity prevents accurately monetizing energy storage, and the difficulty for all stakeholders to obtain reasonable financing.[3] Stakeholders and public entities can use the next three years to work to remove or limit these barriers to allow for a greater ramping up of energy storage deployment in the future. Fourth, the Act requires DOER to reevaluate the procurement targets at least every three years. It also requires electric companies to submit a report to DOER

[2] State of Charge, p. 60.
[3] State of Charge, pp. 61, 67.

demonstrating that they have complied with the procurement targets and policies. DOER's first review could evaluate the success of the pilot projects in the pilot phase and use that information to consider possible target increases.

III. Implementation of the Pilot Phase

The AGO recommends using small-scale, reasonable pilot projects to gather information about how energy storage applications can benefit the distribution system and ensure containment of project costs. The pilot projects could monitor and assess, through appropriately focused proposals and by gathering more granular locational data, the ability of energy storage technologies to mitigate intermittency from on-site renewable generation, to stabilize the distribution system through the provision of frequency regulation services, or to offset peak loads by shifting electricity to hours of higher demand.

As the first step in the pilot phase, each electric company should design and seek approval for its storage plan. Electric distribution companies ("EDCs") should seek approval from the Department of Public Utilities ("DPU") and other electric companies should seek approval from DOER. All electric companies should be required to show that their proposed pilot project is cost-effective, that it addresses a specific system need, and that it provides sufficient benefit and overall value to ratepayers to warrant approval. Each electric company should also indicate how its proposed pilot project will gather data, or contribute in other ways, that will benefit and inform the statewide standards development process. All electric companies with approved pilot projects should report to, and participate in, the parallel stakeholder process so that the process can benefit from the electric companies' experience.

At the end of the pilot phase, each electric company should submit a report to the DPU or the DOER (presumably the report statutorily-required to be submitted to DOER is sufficient) to assess the results of the pilot project.

IV. Considerations for the Future Success of Energy Storage Programs in Massachusetts.

During the pilot phase, DOER and stakeholders should engage in a parallel process to lay the groundwork to enable future successful energy storage programs in Massachusetts. As discussed further below, this should include: (1) a DOER-led stakeholder process to develop a state policy for evaluating the costs and benefits associated with energy storage projects; (2) EDCs proposing and implementing plans to better identify the needs of the electric grid; and (3) the DPU convening a working group to determine an appropriate standard of review for future DPU review of proposed utility-owned energy storage projects.

A. Stakeholder Process to Develop Standards for Evaluating Energy Storage Projects.

The DOER should lead a stakeholder process to develop a statewide standard for assessing the cost-effectiveness of energy storage proposals. In this process, stakeholders could discuss how Massachusetts would evaluate energy storage based on the specific benefits that would flow from the end-use application of the proposed project, whether grid-wide benefits of a specific end-use application should be considered, and how a cost-benefit evaluation would incorporate values associated with energy storage projects that are not easily quantifiable or attributable to specific projects. For example, in Oregon, the state is looking to develop a valuation methodology for energy storage that would assign value to the potential, hard-to-quantify benefits that include: deferred investment in distribution and transmission infrastructure; peak demand reduction and associated generation capacity savings; ability to improve distributed

energy resources ("DER") integration; reduced greenhouse gas ("GHG") emissions; and improved system reliability.[4] DOER and interested stakeholders could evaluate this type of approach and whether a similar valuation methodology would be appropriate for Massachusetts.

The goal would be to develop a cost-effectiveness standard that could apply to all energy storage projects seeking to benefit from state-approved funds, *i.e.* both utility-owned and projects funded independent of utilities through DOER-sponsored programs. A statewide standard for cost-effectiveness that addresses how to appropriately value difficult-to-quantify benefits will ensure that all projects receiving state-approved funds will be evaluated on the same basis.

B. Learning More About the Needs of the Electric Grid.

During the pilot phase, EDCs, with regulator support, should take steps to better identify the needs of the electric grid. DOER's Study highlighted the lack of comprehensive and granular modeling of the electric distribution grid as one of the barriers to successful energy storage implementation.[5] The current system's lack of data makes it more difficult to correctly evaluate proper energy storage siting and how that energy storage can ultimately benefit the rest of the grid.[6] Accordingly, prior to any significant ratepayer investments in energy storage, the EDCs should utilize their grid modernization investments to collect more data, including location-specific data, which will allow for a more accurate assessment of grid need and where energy storage can deliver the greatest benefit.[7]

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[4] Oregon House Bill 2193 (2015), *available at* http://gov.oregonlive.com/bill/2015/HB2193/.
[5] State of Charge, p. 62.
[6] *Id.*
[7] *Id.*

C. Establishing an Appropriate DPU Standard of Review for Future Utility-Owned Energy Storage Projects.

Finally, the DPU should convene a working group to determine an appropriate standard of review for future EDCs' petitions for approval of energy storage projects. This working group could explore the showing that EDCs must make in order to gain DPU approval to move forward with an energy storage project. Potential evidence required in support of energy storage could include: (1) a definition of the problem that needs to be addressed by energy storage; (2) a cost-benefit analysis that shows the energy storage project cost-effectively addresses the problem (if applicable, using the statewide cost-effectiveness standard developed by DOER, as proposed above) and provides ratepayer benefits; (3) a showing that the EDC conducted a competitive procurement process prior to its decision to invest in the energy storage project; and (4) an analysis of alternative solutions or projects considered by the EDC.

The DPU working group could also address the appropriate vehicle for cost recovery of long-term energy storage projects. The working group could investigate whether it is appropriate to include the energy storage costs as part of rate base, as with most other capital investments, or whether these costs should be recovered through a reconciling mechanism on a year-to-year basis, as with, *e.g.*, solar project investments. A proactive decision regarding how costs will be recovered, as well as what type of showing will need to be made in order to gain DPU approval for ratepayer recovery, will provide much-needed clarity for EDCs and stakeholders as they evaluate the viability of various energy storage projects.

V. Conclusion

The AGO strongly supports the development of energy storage targets, and to safeguard ratepayer interests, the Commonwealth should move forward with energy storage in a measured way that ensures that energy storage will be deployed in a manner that will maximize the

benefits provided to the electric grid, and, in turn, the ratepayers. To that end, the AGO recommends the adoption of a small-scale initial energy storage procurement target that will allow electric companies to invest in projects that would gather more information about where and how energy storage can provide the most benefits to the grid and the ratepayers. The AGO also recommends further stakeholder processes to set the foundation for a future successful long-term energy storage program in Massachusetts. The AGO thanks DOER for the opportunity to present these comments and looks forward to working with DOER and additional stakeholders in the near future on these issues.

Respectfully Submitted,

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COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENERGY RESOURCES

Comments of SolarCity and Tesla On Energy Storage System Targets

SolarCity Corporation and Tesla Motors, Inc. ("SolarCity and Tesla") congratulate the Department of Energy Resources ("DOER") on its thoughtful work on energy storage and grid modernization, and in particular its recent decision to establish targets for energy storage systems in the state. This work places Massachusetts on the course for the flexible, resilient, clean grid needed in the 21st century.[1] In going forward with setting the energy storage target, we appreciate the opportunity to comment on the appropriate target scale, structure, and mechanisms for the energy storage systems targets that the DOER will implement. SolarCity and Tesla support the deployment of energy storage systems at a level that provides the maximum benefit to ratepayers. Based on the results of the *State of Charge* report, we propose that the DOER establish programs that support cost-effective energy storage up to the full 1,766 MW determined to provide ratepayers benefits. This will allow Massachusetts ratepayers to realize the maximum benefits of cost-effective energy storage by overcoming the market barriers that currently exist. We also propose that the DOER establish an energy storage procurement target of 600 MW by 2020.

Parties

Tesla is an American manufacturer of advanced electric vehicles and battery energy

[1] Department of Energy Resources (December 27, 2016), "Energy Storage Stakeholder Target Input Request," public email communication.

storage systems. While best known for its vehicles, Tesla also utilizes the battery expertise and production capacity developed for its vehicles to make innovative, cost-effective energy storage systems for use in homes, commercial buildings, and on the bulk electric system. With over 7.5 GWh of total energy storage produced and deployed in vehicles and 125 megawatt-hours ("MWh") of stationary energy storage systems installed and operating, Tesla has extensive experience in both manufacturing and deploying commercial energy storage systems for use on the electric grid.

SolarCity, the largest solar installer in America, is a wholly owned subsidiary of Tesla. SolarCity is the country's leading full service solar power provider – a single source for engineering, financing, design, installation, monitoring, and support. The company has more than 10,000 employees and has installed solar energy systems for over 300,000 customers nationwide. As of October 26, 2016, in Massachusetts, SolarCity had more than 500 employees working in 6 operations centers across the state, including the gateway cities of Fall River and Springfield.

I. SCALE OF THE TARGET

We strongly urge the DOER to establish programs for up to the full 1,776 MW of energy storage identified as cost-effective by the *State of Charge* report and establish a procurement target of 600 MW by 2020. This will allow Massachusetts citizens and ratepayers to achieve the maximum level of benefits from cost-effective energy storage.

The DOER recently issued a *State of Charge* report, one of the most comprehensive reports on the value of energy storage, which concludes that the amount of storage that is

most beneficial to Massachusetts ratepayers is 1,766 MW and 2,125 MWh. The report finds that this level of storage "at appropriate locations in the state, with sizes defined by system requirements and dispatched to maximize capability,"[2] would provide up to $3.4 billion in benefits, with $2.3 billion accruing to ratepayers. In addition, that storage would provide almost 10% reduction in Massachusetts peak demand and reduced CO2 emissions of 1.06 MMTCO2e.[3] Based on these findings, we urge the DOER to establish programs that allow for the procurement of up to 1,766 MW of energy storage.

We recommend that DOER also establish a 600 MW minimum target for storage procurement. According to the *State of Charge* report, while this minimum level of storage will not maximize ratepayer savings, it would provide $800 million in system benefits to ratepayers.[4]

II. STUCTURE OF THE TARGET

The structure of Massachusetts' storage target should reflect the state's restructured industry structure and provide opportunities for all ratepayers to directly benefit from the target. In order to procure the full 1,766 MW of cost-effective energy storage, the DOER should allow 40% of energy storage to be owned by electric companies and establish payment programs for all other energy storage.

[2] "State of Charge," Massachusetts Energy Storage Initiative, P xi, http://www.mass.gov/eea/docs/doer/state-of-charge-report.pdf.
[3] "State of Charge," Massachusetts Energy Storage Initiative, P 103, http://www.mass.gov/eea/docs/doer/state-of-charge-report.pdf.
[4] "State of Charge," Massachusetts Energy Storage Initiative, P i, http://www.mass.gov/eea/docs/doer/state-of-charge-report.pdf.

These payment programs do not represent incentives for a technology that is not yet cost-effective, but payments that represent the value that cost-effective energy storage can provide to the system, but is unable to monetize because of market barriers. As the *State of Charge Report* describes, "in many Use Cases the value that the storage owner/developer can monetize through existing market mechanisms and regulatory constructs is too small for the investment to be made by the storage owner/developer even though doing so would result in net benefits to electric ratepayers. To realize the system benefits modeled, mechanisms are needed to bridge the gap between the cost of energy storage and the revenue captured by the storage owner/developer." [5]

A. Utility Ownership

DOER should determine a maximum percentage of the target that can be fulfilled through electric company ownership of energy storage. We propose that utility ownership of energy storage be limited to 40% of the target. Energy storage that will be directly owned by electric companies should be procured through competitive processes in order to ensure cost-effectiveness. Limiting utility ownership to 40% of the target is appropriate in Massachusetts because of its restructured electric industry. In choosing to implement restructuring, the Commonwealth determined that its electric industry should rely on independent developers for generation and other aspects of the industry that do not represent natural monopolies. Because energy storage can provide transmission and distribution services, we believe that electric companies should be allowed to own some

[5] "State of Charge," Massachusetts Energy Storage Initiative, P xvi, http://www.mass.gov/eea/docs/doer/state-of-charge-report.pdf.

energy storage assets. However, in keeping with Massachusetts' restructured electricity market, it is important that third parties and customers also be allowed to own the assets and support the system. This will enable different business models to develop and the market to evolve at a more rapid pace.

In addition, the need for an energy storage procurement target and energy storage programs comes from the market barriers that energy storage faces in recovering revenue from the system savings and benefits provided by energy storage. Electric companies are significantly better positioned to recover this revenue because in many cases they directly receive the system savings created by energy storage. Because electric companies face fewer market barriers to implementing cost-effective energy storage, a procurement target and programs focused on overcoming those market barriers should be more focused on third-party and customer-owned energy storage resources.

B. Energy Storage Program for Third Party or Customer Owned Systems

DOER should establish an energy storage program that provides a one-time payment to energy storage systems owned by third parties or customers. The payments should be based on the system size as well as the level of optimization, which represents additional value to ratepayers. This type of program provides clear price signals and certainty for developers, which allows that maximum amount of energy storage to be deployed at least cost. In addition to the basic energy storage program, we support added incentives for projects developed in strategic locations and according to operational and size parameters

dictated by DOER or the utilities that will provide greater support to the system and ratepayers.

a. Basic Energy Storage Program One-Time Incentive Payment

We believe the market is best supported by a program that provides certainty as to value and process and is not overly prescriptive. We also believe that we can make the most efficient progress with a program that provides up-front payments for the installation of energy storage. The payment for these energy storage systems would be based on the power capacity of the energy storage system installed. DOER would determine a payment rate ($/kW) that could decline over time in order to reflect decreases in the cost of energy storage and the availability of additional value streams for those systems. Until regulations align incentives for the individual customer and the system and enable monetization of these system benefits, a one-time payment program to incent mutually beneficially operations is needed to monetize those benefits.

The energy storage program would be similar to New York's MegaWatt Block program, which provides one-time incentive payments for the installation of solar generation.[6] The program is also similar to California's Self Generation Incentive Program, which provides one-time payments for the installation of energy storage systems.[7]

We note that if DOER chooses to create a payment level that will decrease over time, it is very important to provide visibility into the exact payment that an individual storage

[6] *See for example:* https://www.nyserda.ny.gov/All-Programs/Programs/NY-Sun/Project-Developers/Commercial-Industrial-MW-Block

[7] *See:* http://www.cpuc.ca.gov/sgip/

project will receive by clarifying at what point in its development an energy storage project will be assigned to a price tranche.

b. Two-Hour Runtime Across Portfolio of Storage

In order to ensure that the energy storage deployed by the program is sized appropriately, we propose that DOER establish a requirement that the average runtime of energy storage procured through the program have a two-hour minimum runtime. The *State of Charge* report found that in order to provide the most benefit to ratepayers, energy storage systems should be sized appropriately, accounting for 1,766 MW and 2,125 MWh. This represents an average system duration of 1.2 hours. Because most energy storage systems are modular, we propose that DOER establish a minimum average runtime of two hours. This will ensure that the energy storage systems deployed as a part of the program are sized appropriately to provide value to ratepayers through energy arbitrage, reduced peak capacity, transmission and distribution cost reduction and integrating distributed renewable generation, all of which require longer runtime storage applications.

c. Operational Requirements

We propose that at the beginning of the program, no operational requirements be established. Instead, optimization of energy storage performance would be incentivized by the additional payments made to optimized energy storage. A base payment for storage without operational requirements is justified because the installed storage will still provide significant system value through serving its primary use case. For example,

energy storage systems that are deployed in order to reduce commercial customers' demand charges operate to serve that customer's peak load. In doing so, the energy storage system will also serve some portion of system and local peaks, to which nearly every customer contributes. As the *State of Charge* report notes, these installations will also provide significant system benefit at an aggregate level for both local and wholesale systems which neither the C&I customers or third parties can fully monetize.[8] Compulsory operational requirements may interfere with the main use case of energy storage projects and thus prevent some energy storage from being deployed, also foregoing the system benefits they would provide.

d. Increased Payment for Optimized Energy Storage

The *State of Charge* report found that after a certain level of energy storage penetration, energy storage needed to be optimized to benefit the system and all ratepayers. It defined optimized energy storage as installations "at appropriate locations with sizes defined by system requirements and dispatched to maximize capability."[9] We therefore propose that DOER clarify that as in the S*tate of Charge* report, "optimized energy storage" is energy storage that: 1) is located at a specific location; 2) is sized as defined by system requirements; and/or 3) operates during high value hours including system and local peak hours.

[8] "State of Charge," Massachusetts Energy Storage Initiative, P 125, http://www.mass.gov/eea/docs/doer/state-of-charge-report.pdf.
[9] "State of Charge," Massachusetts Energy Storage Initiative, P 78, http://www.mass.gov/eea/docs/doer/state-of-charge-report.pdf.

To ensure storage is developed and operated accordingly, we propose that DOER establish separate and higher payments for these projects. The higher payment value would reflect the higher value provided to ratepayers and will address the value discrepancy that often occurs between the optimal size and operation for the host customer and that required for system benefits.

Base Payment	**$/kW installed**
Locational Payment	10% increase over base*
Peak Hour Payment	10% increase over base

**The base payment levels and increased payment levels for optimized energy storage here are illustrative and would need to be determined based on system data and stakeholder engagement.*

i. Optimized Energy Storage Program Characteristics:

1. Location

Based on the study, an increased payment would be made to storage projects located in the areas identified in the *State of Charge* study and any additional locations identified by DOER or electric companies. These locations should be made available to all potential developers as early as possible in order to allow for appropriate planning and development of energy storage projects in that location. In addition, the amount of storage needed at each location and up-to-date information about the amount of energy storage projects already accepted.

The locational payment provides additional revenue to energy storage resources that are located at specific points on the Massachusetts electricity grid that have an additional need for energy or capacity services. Without this payment, energy storage resources

would face market barriers to realizing that additional value because the optimal siting of energy storage may not be otherwise made available and no entity is currently required to provide locational payments at the distribution level. In addition, customers do not pay rates that are based on their specific location on the grid and so would not be able to realize the locational value of energy storage.

2. Peak Hour Production

Because of the high value of energy storage systems that operate during system or local peak hours and therefore reduce energy prices, alleviate congestion, and potentially offset the need for additional peak resources, a higher payment should be made to energy storage systems that operate during these hours.

The peak hour production payment represents the added value for serving local and system peak hours. Smaller customers pay averaged rates energy, distribution, and transmission and larger customers pay averaged rates for at least the distribution and transmission portion of their bills. However, providing peak capacity is far more valuable to the system than those averaged rates represent, creating a market barrier to energy storage that seeks to realize value from serving peak loads. In the wholesale market, the requirement to be able to serve an unlimited runtime undervalues energy storage and creates an additional value to energy storage receiving revenue by serving peak load. Therefore, the peak hour production payment would serve to overcome these market barriers.

e. Residential Energy Storage

Residential energy storage can provide direct benefits to residential customer by providing backup power during system outages and can provide significant value to the system because of its location directly at the customer load, allowing it to offset the need for distribution, transmission, and generation capacity. Therefore, we also propose that DOER create a separate program for energy storage installed behind the meter of residential customers because residential energy storage has significantly different costs from commercial energy storage. The residential storage program would also provide an upfront payment for the installation of energy storage. The payment would be based on the power capacity of the energy storage system. Eligible residential energy storage systems would have a minimum two-hour runtime.

A residential storage program would also include operational signals or requirements for the residential energy storage systems. This will ensure that the residential storage systems are operated in a way that provides system value in addition to providing customers with important back up power. We propose that the DOER establish two payment levels for residential energy storage systems:

- Time of Use Energy Residential Energy Storage Program- in order to ensure that residential energy storage systems are operated in a way that provides system benefits, we propose that DOER provide a payment for residential energy storage systems and require that participating customers also join a Time of Use tariff through their utility.

- Dispatchable Residential Energy Storage Program- to provide an even greater system value, DOER could provide a higher level of payment to residential storage systems that allow an electric company or other utility to dispatch the residential energy storage systems in order to provide system value.

f. Eligibility of All Customers

The DOER should clarify that storage projects and customers in any part of Massachusetts, regardless of electric company territory, will be eligible to participate in the energy storage target.

g. Role of Existing Storage Programs

Energy storage that receives payments or incentives from any program outside of the energy storage target, should contribute to the fulfillment of the energy storage target. For example, if DOER does establish a payment for eligible energy storage paired with solar PV participating in the anticipated new solar program, any storage utilizing that payment would count towards the minimum energy storage target of 600 MW. Existing energy storage programs represent a determination by DOER that specific use cases for energy storage provide additional benefits to the system and ratepayers, making it optimized energy storage, which should also count towards the overall program target of 1,766 MW.

Conclusion

Tesla and SolarCity thank the DOER for the opportunity to comment on the implementation of the energy storage procurement target and look forward to additional engagement as DOER moves forward with finalizing the implementation of the target.

Respectfully submitted,

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Dated: January 27, 2017

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BEFORE THE MASSACHUSETTS DEPARTMENT OF ENERGY RESOURCES

January 27, 2017

Judith Judson, Commissioner
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

RE: Renewable Energy Systems Americas Inc. Reply to Energy Storage Stakeholder Target Input Request Pursuant to an Act Relative to Energy Diversity, Chapter 188 of the Acts of 2016

Commissioner Judson:

Renewable Energy Systems Americas Inc. ("RES") appreciates the opportunity to provide additional feedback to the Massachusetts Department of Energy Resources ("DOER") in this important proceeding. RES commends the Commonwealth for approving a formal storage procurement platform and welcomes the occasion to continue to help shape a storage program that will provide the most effective and affordable storage projects for Massachusetts ratepayers.

Storage Targets

RES recognizes the work that has already been completed in the assessment of storage potential in the Commonwealth as provided by the Massachusetts State of Charge Report.[1] For the purposes of setting initial procurement targets, RES now puts the strongest emphasis on the timeline: a "first round" of projects should be procured no later than 2020. A short-term objective will incentivize storage developers with the largest global positions in the storage market to become immediately engaged in Massachusetts, creating a broad pool of projects developed by the most qualified participants.

While RES encourages a near-term target for project development, RES also asserts that such a timeline requires access to system data for commercial developers. Although some bulk transmission and market data is available via ISO New England, other information, especially distribution and customer-level data, is only accessible through the incumbent distribution utility. RES fully recognizes the sensitivities of grid security and customer privacy surrounding distribution-level data. These concerns can be addressed through a vendor qualification step that ensures adequate protection of utility information. While other factors, such as point of interconnection and permitting, can greatly impact the efficiency of project deployment, access to precise and granular data can keep the up-front modeling processes succinct enough to meet a 2020 procurement objective.

RES also cautions the DOER over being too prescriptive with certain program parameters such as required use cases and points of interconnection for storage projects when establishing procurement targets. This is a critical consideration in such a proceeding, as forcing certain types of storage projects without first evaluating the technical and economic merits can result in projects that misrepresent the advancements made in the industry and reflect poorly upon the

[1] *Massachusetts State of Charge Report*, 2016. Pg 5

potential impact of energy storage for utilities across the country. RES asserts that a project study process will identify storage plants with the greatest potential benefit.

RES again thanks the DOER for the opportunity to provide feedback in this proceeding and looks forward to continued interaction with interested parties.

Respectfully submitted January 27, 2016

Respectfully submitted,

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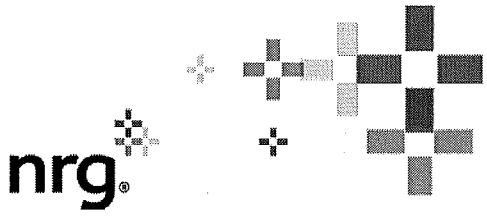

Peter Fuller
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January 27, 2017

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge Street
Boston, MA

Re: An Act Relative to Energy Diversity – Storage Targets

Dear Commissioner Judson:

NRG Energy, Inc. ("NRG") applauds the decision by the Department of Energy Resources ("Department") on December 27, 2016 to adopt targets for energy storage systems pursuant to *An Act Relative to Energy Diversity* (the "Act"), signed into law by Governor Baker on August 8, 2016. NRG supports the establishment of energy storage system targets as a means to begin the deployment of energy storage at the scale that will be necessary to support the low-carbon, highly-responsive energy grid that will enable a high-performance Massachusetts economy in the 21st century.

NRG offers the following comments in response to the Department's request, issued concurrently with the notice announcing the decision to establish targets, seeking input regarding "the appropriate target scale, structure and mechanisms for the energy storage system targets."

Storage is an essential part of the 21st century electrical grid, where it will enable the widespread use of renewable energy and improve the performance and responsiveness of the grid to the power quality needs of consumers. Massachusetts is correct to embrace storage as a key pillar of this energy future, and should adopt achievable but aggressive targets to propel the Commonwealth into a leadership position among the states. The near-term focus on achieving significant deployment of a variety of energy storage technologies in a variety of use cases will ensure that customers, storage technology providers, third-party investors and operators, and utilities all can gain experience with storage and its interactions with the grid, with markets, and with end-use customer demand, to establish a sustainable ecosystem for using storage as an integral part of the grid.

<u>The Legislative Basis for Energy Storage Targets</u>

Section 15 of the Act establishes the framework for the energy storage targets, and directs that the targets should be for "electric companies to *procure* viable and cost-effective energy storage systems." (emphasis added) This legislative directive must be read to establish an affirmative obligation on the utilities to purchase energy storage to meet the targets. The Act provides the flexibility for the Department to "consider a variety of policies" to meet the targets, but also establishes a compliance obligation on the electric companies. The statute clearly envisions the

utilities actively seeking out and facilitating the deployment of energy storage to meet the numerical targets by 2020. To be effective, especially in the limited time between now and 2020, the Department must adopt long-term contracts as the basis for the electric companies to comply.

The legislative framework and directive also need to be read in the context of long-standing Massachusetts policies favoring competitive markets for energy services and competitive procurement of resources to meet state policy objectives. The Department's targets should require the electric companies to solicit proposals from customers and energy storage providers, to leverage innovation and private capital at risk, and execute long-term agreements that provide sufficient revenue certainty to enable cost-effective financing of projects. The focus on third-party and customer-owned projects rather than direct utility ownership is critically important to establish Massachusetts on a path to a sustainable ecosystem for energy storage growth. The experience gained by third parties and by the financial community in developing projects will be extremely valuable in supporting the evolution to a voluntary, market-based environment for energy storage in future years.

The legislative requirement for utilities to file reports showing compliance creates an explicit enforcement requirement, and the Department should provide for sanctions in the event utilities fail to achieve their targets.

Scale of the Energy Storage Targets

The State of Charge report[1] recommends that the Commonwealth seek to deploy 600MW of advanced energy storage by 2025, and estimates that 1,766MW can be deployed in Massachusetts cost-effectively. NRG recommends taking the 600MW goal for 2025 as a reference point in setting the 2020 target called for in the statute. The target should be aggressive and meaningful enough to attract sufficient interest among the technology and financial communities, but not so large as to be unachievable.

NRG recommends that the Department set the energy storage targets for 2020 to accomplish two objectives: move Massachusetts into the top 10 among states in terms of energy storage deployment, and address the highest peak hours to achieve energy cost reductions. According to the State of Charge Report[2], Massachusetts currently ranks 23rd among the states in advanced storage deployment. Moving into the top tier among the states would require an incremental deployment of 100 to 200MW of advanced storage. Also, as noted in the Report, the top 1% of hours of the year accounts for 8% of annual energy cost. With an estimated peak demand of approximately 12,300MW in 2020, deployment of advanced storage equal to 1-2% of that peak load, or 123MW to 246MW, would have a significant impact on state-wide energy costs. Thus, NRG recommends that the Department set a 2020 target of at least 150MW and up to 250MW of

[1] http://www.mass.gov/eea/docs/doer/state-of-charge-report.pdf
[2] id., Figure 6

new advanced storage deployment. This should be viewed as a minimum, and as a milestone on the path toward the State of Charge Report's recommended 600MW and 1,766MW targets. With 150 to 250MW of advanced energy storage deployed by 2020, the Commonwealth will be well-positioned to grow to the 600MW goal by 2025, given projections of continued growth in manufacturing and supply chains as well as declines in cost.

Structure for the Energy Storage Targets

The Department should set the 2020 targets such that 'achievement' of the targets is measured in terms of actual operations of the storage projects. While it will take concerted effort and coordination among developers, customers, the utilities, ISO-NE, the Department and the DPU to complete competitive solicitations and achieve these targets, it is important that the Department express a sense of urgency and shared purpose to advance the deployment of advanced energy storage in Massachusetts.

The targets should be separate and distinct from any advanced storage deployed in response to other policies or initiatives such as solar+storage incentives. With the procurement-based approach that is needed to effectively comply with the Act's directives, all parties will benefit from clarity and certainty in the target quantities and that the targets will not be reduced by other storage projects deployed through other means.

Targets should be distributed across the electric companies, and deploy a number of diverse use cases, with primary focus on grid-connected storage to support integration of renewables and other grid performance needs, C&I dispatchable storage (with or without associated solar), and storage co-located with MW-scale solar.

Mechanisms for the Energy Storage Targets

In all cases, third-party ownership and operation should be the preferred business structure. If utilities are allowed to own advanced storage at all, there should be a firm upper limit on the proportion of the target that they can own. For example, in California utilities are restricted to owning no more than 50% of the 1,325MW target in that state. Experience to date in California suggests that third-party projects are very competitive with utility-owned projects and are identifying innovative customer-oriented business models and technology configurations.

To ensure that this technology continues to advance, and that Massachusetts is well-positioned to take advantage of it, the distribution utilities should procure energy storage under long-term purchase agreements. Even for use cases that are targeted primarily to distribution grid support services, third-party ownership is possible and preferable. First, third-party storage will require clear definition, in commercial agreements, of roles, responsibilities, performance specifications and value drivers for use of storage in support of utility and ISO needs. This will lead to more rapid and more precise resolution of these issues, which will be needed in a more market-based environment for advanced energy storage, than if utilities own and operate. In addition, third-

party owners will be far better-positioned to take advantage of wholesale market participation and revenues.

On a very practical level, achieving the Commonwealth's larger future goals for advanced energy storage will not be possible through utility ownership, and engaging the developer and investor community in this initial deployment effort will inject innovation and advance the experience of independent developers and financiers, which will be necessary to support a sustainable energy storage industry.

Complementary Initiatives

Improving economics of energy storage, coupled with increased demand, will continue to bring storage closer to cost parity with 'traditional' forms of energy supply and delivery. As this happens, the need for state mandates will naturally decrease and storage will become a 'mainstream' technology on the grid and in customer applications, which should be the Department's goal.

In addition to directing utility procurement of energy storage through competitive means from independent storage project developers, the Department should continue to engage with the utilities, ISO-NE and other stakeholders to ensure that storage projects are able to efficiently interconnect to the grid, to effectively participate in markets for the multiple products and services that storage can provide, and to successfully monetize the other values that storage provides to the grid (e.g., through the deferral of transmission and distribution investment). Among the priorities in this regard are accessible and granular maps or similar documentation from the utilities describing high-value areas for storage, such as areas with high penetration of renewables and areas with particularly high peak demands relative to average loading, and refined ISO-NE market rules that facilitate participation by storage resources in the wholesale markets and fully value the flexibility and responsiveness of storage. These foundational elements will need to be firmly in place and well-understood by the development and financing communities to enable an effective transition to a market-based environment for energy storage, independent of state mandates.

NRG appreciates the opportunity to provide these comments and will continue to engage and support the Department and the Commonwealth as Massachusetts pursues a modernized electricity system. Please feel free to contact me with any additional questions.

Sincerely,

Peter D. Fuller

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January 27, 2017

Judith Judson, Commissioner
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RE: Energy Storage Association's Reply to Energy Storage Stakeholder Target Input Request Pursuant to An Act Relative to Energy Diversity, Chapter 188 of the Acts of 2016

Dear Commissioner Judson:

On behalf of the Energy Storage Association ("ESA"), please accept these Comments in response to the Massachusetts Department of Energy Resources' ("DOER") request for comments in the above-referenced matter. ESA members, which include electric utilities, independent power producers, and operators/developers of batteries, flywheels, thermal energy storage and compressed air technologies operating on the nation's electric grids, together have significant experience installing energy systems worldwide. Based on that expertise, ESA recommends an energy storage procurement target intended to accelerate cost-effective storage adoption through learning-by-doing, lowering risk, and ensuring incorporation of advanced storage into regular electric system planning, procurement, and operations. The target should seek to spur development of a broad range of use cases and business models so that regulators, electric companies, and stakeholders can understand what works best in Massachusetts' grid. Concomitantly, the target should balance flexibility to electric companies for achieving compliance with mechanisms to drive customer and third-party deployments. Ultimately, the most effective target will require electric companies and developers to take novel approaches to meeting current needs and change the way they do business to incorporate storage.

Doing so will ensure that the storage procurement target best supports Massachusetts in achieving its greater public policy goals. For example, using storage will support the Commonwealth in its efforts to reach its greenhouse gas emissions reductions goals by avoiding emission-intensive peak capacity, enabling regional grid flexibility for high levels of wind and solar, and unlocking greater contributions from distributed energy resources, including electric transportation. Additionally, accelerating energy storage deployment will enable further grid modernization and enhance infrastructure resiliency, as well as drive economic development.

I. COMMUNICATIONS

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II. ABOUT THE ENERGY STORAGE ASSOCIATION

Since its founding 27 years ago, ESA has promoted the development and commercialization of safe, competitive, and reliable energy storage delivery systems for use by electricity suppliers and their customers. ESA's nearly 200 members comprise a diverse group of electric sector stakeholders, including electric utilities, independent power producers, technology developers – of advanced batteries, flywheels, thermal energy storage, compressed air energy storage, supercapacitors, and other technologies – component suppliers, and system integrators. Several ESA member companies operate in the state of Massachusetts.

ESA's member companies have expertise in transmission- and distribution-level grid operations

relevant to energy storage, as well as firsthand knowledge of the regulatory challenges to operating commercial energy storage facilities to realize full system benefits. ESA looks forward to working with the DOER and other stakeholders in this and related proceedings to ensure that Massachusetts reach its system sustainability and grid modernization goals while ensuring least cost to ratepayers and enhancing system reliability.

III. PURPOSE AND PRINCIPLES OF AN ENERGY STORAGE PROCUREMENT TARGET

Massachusetts will most effectively achieve the multiple goals of electric service affordability, reliability, and sustainability when energy storage is fully integrated into the electric system.

An energy storage procurement target will assist Massachusetts in achieving the Global Warming Solutions Act (GWSA) emissions reduction goals. The *State of Charge* report commissioned by DOER in 2016 found that optimal, wide-scale deployment of 1.76 GW of energy storage in the state would avoid 1 million metric tons of greenhouse gas emissions over a 10 year period in large part due to reduced output more emission-intensive peak generating capacity.[1] Moreover, as Massachusetts seeks higher levels of renewables, there may be diminishing returns to the greenhouse gas emission reductions of those sources if they do not displace more emission-intensive sources such as are used in peak periods.[2] Having energy storage already in place ensures that additional renewable capacity in the state and in the region will have undiminished ability to contribute to meeting emissions reduction goals. This is particularly important for integration of the 1600 MW of offshore wind to be installed over the next 14 years and 9.45 TWh of other clean sources to be procured within the next 6 years, pursuant to state law.[3] Energy storage can efficiently ensure reliability during periods when the

[1] See Massachusetts Department of Energy Resources, *State of Charge: Massachusetts Energy Storage Initiative Study*, Sep 2016, available at http://www.mass.gov/eea/docs/doer/state-of-charge-report.pdf. Additionally, peaking generation generally has higher NOx emissions than load-following and baseload generation and are used disproportionately on poor air quality days, contributing to local ambient ozone and particulate matter levels. See E. Krieger et al., "A framework for siting and dispatch of emerging energy resources to realize environmental health benefits: Case study on peaker power plant displacement," *Energy Policy* 96 (2016) 302–313.

[2] As an example, the California ISO found that the difference between a 33% and 40% renewables standard would lead to only a 2% reduction in greenhouse gas emissions. See slide 54 of CAISO, *Review of the ISO 2014 LTPP System Flexibility Study*, available at http://www.caiso.com/Documents/Presentation_2014LTPPSystemFlexibilityStudy_SHcall.pdf

[3] H4568: *An Act to Promote Energy* Diversity, *2016*, available at https://malegislature.gov/Bills/189/House/H4568

grid experiences significant "ramping" requirements; ISO-NE has identified winter morning ramp periods as particularly taxing on the New England electric grid already and dispatches larger, slow-moving coal- or gas-fired generators out-of-merit in advance of long, steep load increases common to winter mornings.[4] Accelerated energy storage deployment will ensure that Massachusetts' forthcoming renewables deployments will not further exacerbate system ramps, regardless of the timeline of ISO-NE's efforts to address these issues. Additionally, the availability of energy storage significantly reduces the curtailment risk for future renewables, positively affecting the risk-return profile of renewables projects while also assuring that their output can be counted on for emissions reduction.[5]

Additionally, accelerated energy storage procurement from a target will increase the contributions that DERs can make to greenhouse gas emissions reductions. The transportation sector presently accounts for roughly 40% of Massachusetts' greenhouse gas emissions.[6] As the state moves to encourage adoption of more low- and zero-emissions vehicles, those vehicles will primarily be electric, each of which will constitute a new load on a distribution circuit. Energy storage increases the DER hosting capacity of substations and circuits by time-shifting loads to avoid thermal violations; thus, having energy storage already in place on the distribution system can proactively address reliability concerns from higher electric vehicle penetrations. Similarly, as Massachusetts seeks to add more rooftop solar to contribute to emissions reduction goals, clusters of customer-sited systems can increase net flows into the grid. Energy storage increases the DER hosting capacity of circuits by absorbing excess generation to store backfeed electricity from distributed solar, better ensuring that the distributed solar capacity can displace other system generation.

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[4] *Post-Technical Workshop Comments of ISO-NE, Inc.* FERC Docket No. AD14-14-000. 6 Mar 2015, available at http://iso-ne.com/static-assets/documents/2015/03/ad14-14-000_3-6-15_price_formation_post_tech_comments.pdf

[5] For examples of how storage contributes to integrating more renewables while reducing curtailment risk, see:

- NREL, *Low Carbon Grid Study: Analysis of a 50% Emission Reduction in California*, Jan 2016, available at http://lowcarbongrid2030.org/wp-content/uploads/2016/01/1601_Low-Carbon-Grid-Study-Analysis-of-a-50-Emission-Reduction-in-CA-Executive-Summary.pdf
- UCS, Achieiving 50% Renewable Electricity in California, Aug 2015, available at http://www.ucsusa.org/sites/default/files/attach/2015/08/Achieving-50-Percent-Renewable-Electricity-In-California.pdf

[6] Massachusetts Office of Energy and Environmental Affairs, "2013 MA & US GHG by Sector," *MA GHG Emissions Trends* website, available at http://www.mass.gov/eea/air-water-climate-change/climate-change/massachusetts-global-warming-solutions-act/ma-ghg-emission-trends/

Beyond these goals, having in place a framework for storage procurement ensures that is a viable option to increase state resiliency to unexpected events, such as infrastructure failure. Targeted distributed storage deployments will contribute to ensuring continuity of services at critical locations, such as sheltering facilities and gasoline stations, during extreme weather or other prolonged events of electric system disruption.[7]

An energy storage procurement target will accelerate deployments and ensure that significant near-term benefits are realized for Massachusetts if it follows several principles.

A successful energy storage procurement target will drive learning-by-doing across a broad range of use cases and business models. Massachusetts electric companies, customers, and regulators would have difficulty predicting the optimal approaches to storage deployment in advance of attempting them. Considerable effort is still needed to identify opportunities for cost-effective energy storage deployment on the distribution system. This is in part because, as outlined in the *State of Charge* report commissioned by DOER, some of the system benefits storage technologies offer are challenging to quantify, both operationally and financially. At the same time, it remains to be seen what business models will work best under the regulatory and market structures of the Massachusetts electric system. Corollary to this, the storage target must be of sufficient magnitude to meaningfully explore a diversity of use cases and test competing business offerings for those use cases.

Driving learning-by-doing through a diversity of approaches requires managing a tradeoff between allowing discretion for compliance and ensuring competitiveness in deployment. On the one hand, electric companies should be afforded significant latitude in how they comply with the procurement target. Both because they are the responsible parties for compliance and because the optimal approaches may not currently be known, electric companies are most likely to meet the target successfully if they have full discretion in how to do so. On the other hand, competition is critical to ensure that innovation in energy storage is not slowed and to drive price revelation that ensures least cost for ratepayers. Storage may act like wires infrastructure in

[7] For example, New Jersey's Energy Resilience Bank funds energy storage as emergency back-up power for essential service at sites of critical need. See more on NJ BPU's Renewable Electric Storage Program at http://www.njcleanenergy.com/renewable-energy/programs/energy-storage

some use cases, but storage is not a natural monopoly like wires infrastructure, as there are not the same barriers to entry for competitive provision. At the same time, customers and third-parties may not have access to system information that would optimize deployments, and they cannot seek cost-recovery for their investments from regulators in the same way as electric companies; as such, customers and third parties may face information asymmetries and structural disadvantages to financing storage. A successful target will require balancing these principles.

Additionally, a successful storage procurement target will spur development of a more general enabling regulatory framework for incorporating storage into normal electric sector processes and operations. By undertaking actual deployments, regulators, electric companies, and stakeholders will discover and deliberate on rules and processes for the planning, procurement, installation, and operation of energy storage projects—many of which may be difficult to assess in advance or without a specific instance motivating the discussion. In that same vein, the design of a target will structure the mechanisms used to support storage deployments. A successful target will lead to a framework that provides sustainability of efforts beyond the target alone.

Finally, a successful storage target draws on past lessons to reach farther more quickly. After five years of working through procurements in the California energy storage target, storage industry members have greater experience in deploying storage and expect that a cycle of procurement and deployment in Massachusetts can occur faster than previous efforts across the country. Moreover, stakeholders from the California experience have deliberated at length on a range of questions that are likely to arise in Massachusetts' target, from program design and proposal evaluation to interconnection processes and operating parameters. Thus, similar discussions need not reinvent the wheel and may proceed more quickly in Massachusetts.

IV. ESA RECOMMENDATIONS ON SCALE, STRUCTURE, AND MECHANISMS

ESA recommends that DOER establish a target of 600 MW of energy storage contracted or in development by January 1, 2020, with the expectation that up to 400 MW of the target will be operational by that date. Projects should be additional from the date of authorizing legislation—that is, contracted or installed after Aug 1, 2016 The target should be binding, e.g., backed by

monetary penalties for non-compliance.[8] The target should be assigned to electric companies proportional to the 2014-2016 average peak demand (MW) of their Massachusetts service territory.[9] ESA recommends DOER direct the electric companies to file storage procurement plans by Jan 1, 2018, to provide visibility into methods for achieving the targets.[10] ESA also recommends that DOER establish aspirational goals for subsequent years as an indication of market expectations to electric sector stakeholders and other policymakers. In addition, ESA recommends that DOER adjust those aspirational goals for future years based on its review of the 2020 compliance reports.

ESA's recommendation is a "no-regrets" target. The 2016 *State of Charge* report commissioned by DOER presented cost-benefit analysis supporting procurement of 1,766 MW and discussed recommendations to support 600 MW of energy storage that would provide $800 million of benefits for Massachusetts ratepayers.

Procurement of 600 MW is an achievable goal. The first energy storage procurement by a single California electric company resulted in contracts for a total of 264 MW,[11] and since then the California electric companies have procured storage in regular cycles of 200 MW in aggregate or more.[12] Drawing from this experience, ESA expects that Massachusetts electric companies are capable of comparable levels of procurement at a minimum and can draw on lessons learned in solicitation design to accelerate procurement cycles.[13] Similarly, with several years of accumulated development experience, storage industry members are confident that project deployments in Massachusetts can proceed at a faster rate than initial deployments in California.

[8] Alternative compliance payments may not be appropriate, as they are premised on an output-based (kWh) measure, even though many energy storage services (ancillary services, capacity services) have values independent of the quantity of energy output. ESA recommends that DOER seek further comment from stakeholders on a penalty mechanism, once all stakeholders have provided input on target scale and structure.

[9] Given that some electric companies will have particularly small targets as a result of this allocation, ESA asks DOER to consider allowing an electric company exceeding their target to offer that excess as compliance for other electric companies.

[10] ESA suggests that plans will be for informational purposes and not constitute any binding commitment for electric company activities.

[11] "Inside Southern California Edison's Energy Storage Strategy," *Utility Dive*, 22 Sep 2015, available at http://www.utilitydive.com/news/inside-southern-california-edisons-energy-storage-strategy/406044/

[12] Electric Power Research Institute, *Energy Storage Valuation in California*, Dec 2016, available at http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002008901

[13] ESA also notes that Massachusetts electric companies will be opening RFPs for 1200 MW of hydro and Class I renewable resources this year, less than one year from initiation of RFP design.

Storage industry members are already speeding up delivery times, as recently demonstrated by deployment of over 70 MW of energy storage approximately just 6 months after contract approval.[14]

Moreover, the use of mechanisms to drive customer and third-party deployments will enable greater procurement volumes over the same time frame. Storage unit costs have declined significantly in recent years and continue to do so,[15] suggesting state program funds can leverage an increasing volume of installation over time.

Further, a 600 MW procurement target is of sufficient size to drive broad learning-by-doing for electric companies, regulators, and stakeholders. With recent U.S. storage deployments ranging from 10's to 100's MW of capacity, a smaller target risks being achieved with just a handful of large projects, limiting the range of approaches that are tested.[16] In addition, a target of this size creates sufficient opportunities for testing different business models.

In structuring the procurement target, all ownership models of storage should be utilized to meet the target if and only if DOER balances flexibility for electric companies' compliance with assured opportunities for competing business models. Given that electric companies possess informational advantages over third-parties and customers,[17] ESA recommends that DOER ensure a broad range of competing approaches by including a sub-target of 40% (240 MW) for

[14] SCE is procuring 47 MW and SDG&E is procuring 37.5 MW of energy storage as an expedited procurement in response to the Aliso Canyon gas infrastructure failure. See https://www.greentechmedia.com/articles/read/The-State-of-US-Energy-Storage-in-7-Slides

[15] IHS estimates total installed costs to decline 50% by 2020. See IHS, *Future of Grid Connected Energy Storage*, Nov 2015, available at https://technology.ihs.com/512285/grid-connected-energy-storage-report-2015. See also: UBS, *US Battery Storage: Upstream Supply Chain Biggest Winner of EVs*, Oct 2016, available at https://neo.ubs.com/shared/d1Wg6h8EJsbg/; GTM Research, *Grid-Scale Energy Storage Balance of Systems 2015-2020*, Jan 2016, available at https://www.greentechmedia.com/research/report/grid-scale-energy-storage-balance-of-systems-2015-2020; and IHS, *Energy Storage Inverter (PCS) Report*, Sep 2016, available at https://technology.ihs.com/523547/energy-storage-inverter-pcs-report-2016

[16] Industry members involved in California procurements report that, without an explicit target for behind-the-meter storage, electric companies would have chosen fewer, larger procurements at the transmission and distribution level rather than seek smaller, more distributed behind-the-meter storage projects.

[17] As discussed in the recent MIT *Utility of the Future* study, given the advantages of electric companies' access to customer data and relationships, a lack of independence between distribution system operations and distributed energy resource offerings will create an unlevel playing field for providers of distributed resources. This in turn will tend to reduce economic efficiency, i.e., potentially incurring otherwise avoidable ratepayer costs. See *MIT Utility of the Future Study*, Dec 2016, available at https://energy.mit.edu/wp-content/uploads/2016/12/Utility-of-the-Future-Full-Report.pdf

storage owned by customers or third-parties, in line with the *State of Charge* report's assessment of the proportion justified by cost-benefit analysis.[18] Also, given the informational advantages of front-of-meter assets for providing grid services,[19] ESA further recommends half of that sub-target (120 MW) be for behind-the-meter storage, in line with the *State of Charge* report's assessment of the proportion justified by cost-benefit analysis.[20,21] Ultimately, ESA respectfully requests DOER uphold competitive provision of energy storage; if DOER does not elect to use sub-targets, ESA strongly recommends limiting utility ownership or using other means to assure meaningful competition in Massachusetts.

Note that storage deployments outside of electric company solicitations will count toward compliance for these sub-targets. For this reason, ESA recommends that the mechanisms used to meet the target be designed to elicit a diversity of use cases and business models.

ESA expects the greater proportion of the target to be achieved through direct solicitations by electric companies.[22] These solicitations, which are eligible for cost-recovery as part of electric company investments subject to DPU approval (if necessary), should include:

- **Solicitations for energy storage build-transfer contracts.** Electric companies issue competitive RFPs and, where appropriate, sign bilateral contracts for front-of-meter energy storage projects that are owned and operated by the electric company.

- **Solicitations for customer & third-party offers of energy storage.** Electric companies issue competitive RFPs for energy storage projects that are owned by customers or third parties. Contracts are based on specified service delivery (e.g., load-shaving), a tolling

[18] See Table 5-2 in *State of Charge,* 2016. Behind-the-meter and microgrid use cases account for 20.5% and merchant front-of-meter use cases account for 21.5% of storage justified by cost-benefit analysis.

[19] By installing front-of-meter storage in one area, electric companies may in effect dilute the grid value of behind-the-meter storage investments in that area, adversely affecting project economics for customers while using ratepayer funds to do so.

[20] See Table 5-2 in *State of Charge,* 2016. ESA notes that cost-benefit analyses of behind-the-meter assets did not include potential revenues from either wholesale markets or from distribution system services, and that cost-benefits may turn out to be higher.

[21] Distribution utilities have direct access to customers and branding advantages over third-party installers, presenting barriers to entry and innovation for private companies and the potential for anti-competitive activity. At the same time, ESA recognizes that dispatch control may be necessary to align behind-the-meter unit operations with electric company system needs.

[22] ESA expects that approximately 83% (500 MW) of the target will be met by electric company solicitations. Based on ESA's recommended sub-targets, this would result in requiring 28% (140 MW) of electric company solicitations to seek storage owned by third-parties or customers.

agreement, or other arrangement that establishes payments over a period of 5 or more years.

Storage procurements can come from both storage-specific solicitations and existing multiple-source solicitations as a part of rate cases. ESA also recommends that electric companies use funds in their Three-Year Energy Efficiency Plans to procure storage installations that provide peak load reductions. ESA suggests that storage be explored in the Grid Modernization Plans (GMP) as input for solicitations and can be included either by amendment to GMPs that were filed in 2015 or in future GMPs.

The remainder of the target could be achieved through programs and market opportunities that do not require solicitations by electric companies.[23] Storage projects that have requested interconnection or are in service in an electric company's territory as of Jan 1, 2020, would count toward that electric company's compliance. ESA recommends DOER utilize several programs to drive storage deployments outside of electric company direct solicitations:

- **Next Generation Solar Incentive.** ESA understands that DOER is currently finalizing this program, which among other things will provide an incentive adder on a $/kWh basis for solar power facilities that include energy storage. Based on previous stakeholder discussions regarding the Next Generation Solar Incentive design and queue, ESA believes that at least 200 MW of solar projects will be qualified by 2020. ESA expects that a substantial proportion of these installations will include energy storage, including both front-of-meter and behind-the-meter.

- **MOR-Storage Rebate.** Modeled on the state's MOR-EV program, DOER can allocate ACP funds as rebates to customers for installing energy storage projects. A similar program in California, the Self-Generation Incentive Program, provides a rebate for energy storage technologies based on installed energy capacity (kWh), with amounts declining over time. This program would drive behind-the-meter storage installations and 3rd-party business models.

- **Alternative Portfolio Standard.** ESA recommends that DOER initiate a proceeding to include currently ineligible energy storage technologies into the APS definitions of eligible resources, including a determination of a method for calculating AECs. Energy

[23] ESA expects that approximately 17% (100 MW) of the target will be met by program- and market-driven installations, all of which will satisfy the sub-targets for third-party and customer ownership.

storage installations would receive AECs, which electric companies can then purchase for compliance with state APS requirements. Currently, electric companies remain short of AECs to meet compliance obligations (approximately 50% as of 2014 compliance),[24] indicating that storage eligibility for the APS would very likely result in further AEC purchases. This program would provide incentives to both front-of-meter and behind-the-meter storage. ESA also recommends that DOER investigate other certificate approaches, either instead of, or in addition to, the APS as appropriate.[25]

- **Community Resiliency Grants.** Customers avail competitive grants to install storage at critical facilities to ensure continuity of service. This program would drive primarily behind-the-meter storage, including microgrid deployments.

Finally, 3rd-party owned storage assets may be developed to meet new market opportunities from exogenous activities. Merchant assets may be developed to avail ISO-NE market. ISO-NE rules and market design are likely to undergo changes in the near-term in compliance with forthcoming orders from the Federal Energy Regulatory Commission;[26] upon implementation, ESA expects that more storage will be deployed, including behind-the-meter storage assets that are able to add wholesale revenues to retail or end-user services. Additionally, competitive retail suppliers may choose to provide energy storage to customers for optimizing their own service delivery. In both cases, ESA recommends that installed storage count for compliance in the

[24] See *Massachusetts RPS & APS Annual Compliance Report for 2014*, May 2016, available at http://www.mass.gov/eea/docs/doer/rps-aps/rps-aps-2014-annual-compliance-report.pdf

[25] Other concepts include:

- *Clean Peak Standard*. Separate from the RPS/REC system, this approach designates a percentage of on-peak energy deliveries that must come from eligible resources and awards a Clean Peak Certificate (CPC) for each MWh of those on-peak deliveries. Being technology-neutral, the mechanism would include storage as one of several eligible resources. The CPC approach is compatible with Massachusetts' extant REC/AEC system and would use the same alternative compliance payments. For more information on this concept, see Arizona Residential Utility Consumer Office, *Evolving the RPS: A Clean Peak Standard for a Smarter Renewable Energy Future*, Dec 2016, available at https://www.strategen.com/s/Evolving-the-RPS-Whitepaper.pdf
- *Storage Capacity Certificate*. Grid-connected storage capacity is awarded a Storage Capacity Certificate (SCC), which denotes 1 kW installed and operational over the course of 1 year. Since these certificates are based on installed capacity, rather than delivered energy, they represent a separate compliance mechanism from Massachusetts' extant REC/AEC system and would thus require separate rules and new kinds of alternative compliance payments or other penalties.

[26] Draft rules from the Federal Energy Regulatory Commission (FERC) have been issued that would require removal of barriers to storage wholesale market participation and methods for expediting storage interconnection for wholesale service. See *Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*, FERC Docket No. RM16-23-000, 17 Nov 2016, available at https://elibrary.ferc.gov/idmws/file_list.asp?accession_num=20161117-3094. See also *Reform of Generator Interconnection Procedures and Agreements*, FERC Docket No. RM17-8-000, 15 Dec 2016, available at https://www.ferc.gov/whats-new/comm-meet/2016/121516/E-1.pdf

territory where it is installed.

V. NEXT STEPS

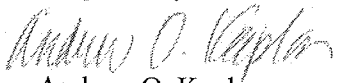
Recognizing the diversity of viewpoints among stakeholders in comments, ESA recommends that DOER convene stakeholders in a technical workshop to further assist DOER to develop the energy storage procurement target scale, structure, and mechanisms. A workshop would provide the opportunity to explore in greater detail the design of all mechanisms, both electric company solicitations and standalone programs, to determine that they provide an achievable path to compliance with the storage procurement target. The workshop would provide a venue for deliberating on the balance between providing flexibility for compliance and ensuring competitive provision of storage, as well as explore different methods for enabling competition. Additionally, the workshop could assess risks of non-compliance and discuss proposals for appropriate non-compliance penalties. Moreover, this workshop will establish a framework for electric company plans to meet target compliance that ESA recommends.

VI. CONCLUSION

ESA respectfully requests that DOER consider the preceding recommendations in establishing a binding energy storage procurement target. ESA looks forward to working with DOER and other stakeholders to determine an optimal approach to energy storage procurement that best meets the electric system affordability, reliability, and sustainability goals of Massachusetts.

Dated on the 27th day of January, 2017.

Respectfully submitted,



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January 27, 2017

Judith F. Judson, Commissioner
William Lauwers, Director of Emerging Technologies
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

RE: NEC Energy Solutions, Inc.

Dear Commissioner Judson and Mr. Lauwers:

Attached please find Comments by NEC Energy Solutions, Inc. in support of the Department of Energy Resources' determination of the scale and scope of an energy storage procurement target for the Commonwealth of Massachusetts.

Should you have any questions pertaining to these Comments, please contact either Bud Collins, CEO or Roger Lin, Senior Director of Product Marketing. Mr. Collins can be reached at 508.497.7267; Mr. Lin can be reached at 508.497.7261.

Sincerely,

Andrew O. Kaplan

Andrew O. Kaplan

Enclosure
AOK:aoh

NEC ENERGY SOLUTIONS

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COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF ENERGY RESOURCES

Evaluation by Department of Energy Resources)
Of Energy Storage Procurement Targets)

COMMENTS OF NEC ENERGY SOLUTIONS, INC.

NEC Energy Solutions Inc. ("NEC Energy Solutions" or the "Company"), a Massachusetts company that develops and manufactures advanced energy storage systems and services that are operating worldwide is pleased to provide the Massachusetts Department of Energy Resources ("DOER") with its recommendations on the appropriate target scale and structure that the Commonwealth should adopt to encourage the cost-effective deployment of energy storage systems.

Since 2008, NEC Energy Solutions has deployed its energy storage systems throughout the United States as well as internationally. As a result, the Company has significant experience understanding how regulatory and economic incentives, including meaningful and attainable procurement targets, have been used successfully to ensure that the benefits of energy storage are available to ratepayers and utility operators. We look forward to sharing our experiences and making recommendations to DOER on the scale and structure of an energy storage target for the Commonwealth.

NEC ENERGY SOLUTIONS

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I. COMMENTS

1. The Scale of the Energy Storage Procurement Target

NEC Energy Solutions respectfully requests that DOER implement a binding procurement target that is meaningful and attainable within the timeline established by the Massachusetts Legislature.

The *State of Charge: Massachusetts Energy Storage Initiative Study* (*"State of Charge"* or the "Report") included a recommendation that Massachusetts implement a procurement target of 600 MW of energy storage by 2025. [1] This is a reasonable goal accurately calculated based on current data about the availability of energy storage resources that are operating on the grids worldwide. However, the Company recommends that DOER establish a target based not on a goal for 2025, but on a meaningful and binding procurement target that is attainable within the next three years. NEC Energy Solutions proposes that such a target is 300 MW, to be procured by January 1, 2020, and installed by January 1, 2022.

Specifically, it is desirable to achieve as much energy storage as reasonable by January 2020 to allow earlier realization of the $800M in cost savings to ratepayers and make a more immediate impact on the energy landscape in Massachusetts. Thus, NEC Energy Solutions recommends that DOER implement a mandatory procurement target of 300 MW by 2020 at roughly 100 MW per year, which is not unreasonable given the recent pace of energy storage activity. Our determination that such a target is easily attainable is based on storage projects recently installed in two states.

In California, to supplement the Aliso Canyon shortfall, 95 MW of energy storage over about a half dozen projects was installed in a matter of months. Moreover, in Massachusetts, NEC Energy Solutions installed an energy storage project for Sterling Municipal Light

[1] *See* Report at 150.

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Department, which was operational within eight weeks of groundbreaking. Based on this, installing a targeted amount of 300 MW in Massachusetts by 2020 is clearly attainable. Accordingly, energy storage is readily available for procurement by Massachusetts utilities and other electric systems in the Commonwealth.

"Procured" energy storage should be defined as any energy storage, other than pumped hydro, that is contracted, in development or operational between December 31, 2016 (the date that DOER determined that implementation of procurement targets are prudent) and January 1, 2020.

2. The Structure of the Energy Storage Procurement Target

In Determining the Structure, NEC Energy Solutions Recommends that the Procurement Target be Pro-rated in accordance with the served load of each Massachusetts Electric Distribution Company.

As has been demonstrated in California, where the State implemented an energy storage procurement target, the addition of storage resources on the grid has resulted in resilient systems that have benefited utility ratepayers. Based on the stakeholder interest in the DOER's docket designed to establish an energy storage procurement target in Massachusetts and the additional technologies and companies that have begun operating since California initially implemented its target in 2010, it is clear that the Commonwealth's ratepayers will experience similar or greater benefits from the provision of energy storage.

To receive the most value for their storage procurement, the DOER should establish separate targets for each of the three Massachusetts regulated utilities, proportional to their MWh load served, in a structure similar to determining alternative energy procurement obligations, and such that the sum of the three utilities' targets is 300MW.

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NEC Energy Solutions is also in support of DOER requesting Municipal Light Plants ("MLPs") to voluntarily purchase energy storage systems so that their ratepayers can experience similar benefits as those of utility customers. NEC Energy Solutions advocates working with the MLP community to identify ways to incentivize them to adopt energy storage into their systems as they have the potential to be fast-movers with high benefit-cost ratios as defined by the DOER "State of Charge" report.

In terms of ownership of the facilities, NEC Energy Solutions supports having the procurement target be fulfilled either by utility ownership of the storage projects and paid for in rate base or by third-parties owning and operating, with the utilities procuring services from those third-parties or purchasing alternative energy credits from them.

Additionally, the Company supports having an added requirement that the 300MW procurement target have a provision that requires installation and commissioning of the energy storage projects by January 1, 2022.

II. CONCLUSION AND PROPOSED NEXT STEPS

NEC Energy Solutions appreciates the DOER's commitment to establishing an attainable target by which utilities would procure (*i.e.,* contract for, develop or operate) energy storage resources by January 1, 2020. Based on the Company's significant experience in this sector, NEC Energy Solutions recommends that the mandatory target should total 300 MWs and be pro-rated in accordance with the load served by each of the Massachusetts utilities. NEC Energy Solutions also respectfully requests that DOER implement the other recommendations contained herein.

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NEC Energy Solutions notes that in initial comments, each stakeholder will provide the DOER with their recommendations on whether a procurement target should be established and, if so, at what level. As next steps, NEC Energy Solutions recommends that DOER schedule a technical session to further discuss the rationale for establishing the target at a certain level, how the target should be structured and by what mechanism the target can be attained.

Respectfully submitted,

Bud Collins, CEO
NEC Energy Solutions, Inc.
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Email: bcollins@neces.com

Dated: January 27, 2017

January 27, 2017

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge St, Suite 1020
Boston, MA 02114

Re: Energy Storage Stakeholder Target Program Design

Dear Commissioner Judson:

On behalf of Sunrun, Inc., please accept these comments in response to the Massachusetts Department of Energy Resources ("DOER") request for comments in the above-referenced matter on the topic of designing an energy storage procurement target. Sunrun is the nation's largest dedicated rooftop residential solar company and is now a leader in deploying residential solar plus storage.[1] We thank DOER for deciding to set a target and for the opportunity to comment on its design.

Summary of recommendations:

1. Set a mandatory target of 600 MW or 5% of Massachusetts peak load of 12 GW.
2. Further divide the 600 MW equally over four years (150 MW annually).
3. Divide the annual 150 MW target between two buckets: 50% allocation for transmission and distribution (T&D) connected storage and 50% allocation for behind the meter (BTM) storage. This would result in an annual procurement target of 75 MW for each bucket.
4. Further reserve 50% of the BTM storage for residential customers, with no minimum size. This would result in a 37.5 MW annual target for residential.
5. Divide the annual targets among load serving entities (LSEs) based on their peak

[1] See, e.g.: https://cleantechnica.com/2016/12/15/sunrun-starts-selling-brightbox-california/

load ratio share. If an LSE does not meet its target one year, carry forward to the next year.

6. LSEs should procure T&D connected storage through an annual storage solicitation and use a standard contract and solicitation protocols.
7. LSEs should not be able to own BTM storage. There should be an incentive mechanism for BTM storage similar to California's Self Generation Incentive Program (SGIP).
8. All qualified residential storage systems should meet minimum technical requirements.

Target Size

We recommend that the Massachusetts Department of Energy Resources (DOER) set a target of 600 MW or 5% of Massachusetts peak load of 12 GW. DOER should also consider setting targets beyond 2020 to provide long-term market commitment and stability. This will help to drive the cheapest and best deployment. Regardless of whether post-2020 goals are set, any remaining balance of the target not met by 2020 should be carried forward into out years.

DOER should further consider creating the following check: divide the target equally over four years. If an LSE does not meet its target one year, carry forward to the next year. The four-year approach ensures that LSEs can capitalize on storage technology getting cheaper in the future and will allow the market to respond as it develops in Massachusetts. Projects that were procured, but later cancelled, should also be added to the next year's target. To meet a particular year's target, projects should be contracted, in development, or operational in that year. Ultimately, all projects under the target should be in service by 2022.

DOER should consider dividing the storage target based on peak load ratio share among the Load Serving Entities (LSEs). This will enable a fair and efficient allocation of the target between the LSEs. Finally, only incremental storage procured after, e.g., January 1, 2017 should be counted toward the target.

Lessons From California

California can prove an instructive example for storage policy initiatives. In 2013 the California Public Utilities Commission (CPUC) enacted the nation's first energy storage mandate, directing investor-owned utilities to buy 1,325 MW by the year 2020. Additionally, in 2016, the California legislature doubled the Self-Generation Incentive

Program (SGIP)[2] budget, allowed the state's investor owned utilities to invest in up to 500 MW of storage projects, and directed the CPUC to evaluate the role that large-scale storage can play for the integration of renewable energy. Also in 2016, the CPUC approved expedited storage purchases for utilities near the Aliso Canyon gas leak, which depleted local gas supplies for generators. SDG&E announced a 150 MWh storage project for the region, and SCE unveiled a plan to retrofit an existing gas plant with 80 MWh of batteries. PG&E announced it would retire the Diablo Canyon nuclear plant and replace it with zero-carbon resources, a task that will require it to store renewable power for use during peak demand hours.

In a nutshell, California has proved that storage is a solution to greenhouse gas reduction, renewable integration, and replacement of nuclear and gas-powered generation, among other services.

Various studies predict that energy storage prices will continue declining rapidly. Therefore, we believe that DOER should set an ambitious energy storage target since energy storage is a clean and increasingly cost-effective solution to meet several generation and grid integration needs. Massachusetts has the advantage of established companies waiting on the sidelines and pipelining projects pending the finalization of storage policy. These companies have gained experience from markets like California and Hawaii, and are positioned to enter the Massachusetts market with mature business models and mature and cheaper offerings.

California has blazed the trail for how to develop an energy storage market. This has led to some mistakes that Massachusetts will not have to repeat, but it also provides a blueprint for how to successfully create a storage program. For example, in defining an incentive mechanism for residential storage, DOER can look to CA's Self-Generation Incentive Program rather than creating a mechanism from whole cloth. Through SGIP, the CPUC offers rebates to utility customers who install clean and energy-efficient distributed generation and storage technologies that reduce on-site electrical demand and greenhouse gas emissions.

In order to evaluate the merits of SGIP, the CPUC engaged Itron to study the impacts of SGIP for calendar years 2014-2015. The Itron 2014-2015 impact evaluation report ("Itron report")[3] concludes that SGIP continues to:

1) reduce GHG emissions;

2) provide peak demand and energy reduction;

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[2] SGIP is an incentive program targeted towards customer connected storage. The SGIP program provides rebates for qualifying distributed energy systems installed on the customer's side of the utility meter. Residential energy storage receives a rebate level of $0.50/Wh, which gradually steps down.

[3] http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442451496

3) provide reductions in aggregated non-coincident customer peak demand;

4) reduce emissions of criteria air pollutants; and

5) leverage rate payer funds.[4]

The Itron report also concludes that as of the end of 2015, SGIP had provided $656 million in incentives to projects with an estimated total project investment of $2.3 billion; representing a leverage ratio of greater than 3.5 to one. This does not even account for the full benefits that SGIP resources provide to the grid. Undoubtedly, the SGIP program has been successful in achieving its stated intent of reduction of GHG gases and provided several additional benefits to the grid.

SGIP will invest more than $60 million in residential energy storage, leveraging hundreds of millions of dollars in private investment and grid benefits. We urge DOER to adopt a similar program in Massachusetts to incent the installation for residential storage.

Target Structure

In achieving maximum efficiency and desired deployment, the structure of a target is as important as the target itself. In order to ensure that a single market segment does not absorb a disproportionate amount of the target, sub-targets should be set. Otherwise, the cheapest and largest scale storage, rather than the most valuable, will be deployed.

Sub-targets should be allocated based on a storage system's point of interconnection – storage benefits attributable to grid functionality may differ from the specific point of interconnection. Further, this focus will provide the utilities flexibility on breaking down their procurement targets by functions depending on their needs. In illustration:

Grid Interconnection Point	Use-case examples
Transmission and distribution connected	(Co-located energy storage) Concentrated Solar Power, Wind + Energy Storage, Gas Fired Generation + Thermal Energy Storage (Stand-Alone Energy Storage) Ancillary Services, Peaker, Load Following Voltage Support Substation Energy Storage (Deferral)
Behind-the-Meter	Bill Management/Permanent Load Shifting, Power Quality, Electric Vehicle Charging, Peaking Capacity, Ancillary Services, Load Following, Voltage Support, Utility Infrastructure Deferral, Backup Power

[4] SGIP 2014-2015 Impact Evaluation Report (page 15-16)

DOER should consider dividing the sub-targets between two buckets: 50% allocation for transmission and distribution (T&D) connected storage and 50% allocation for behind the meter (BTM) storage (50%), with no minimum system size. Diversity of energy storage is important in achieving the greatest ratepayer benefit. Storage connected at the T&D level serves different functions to the grid. Additionally, the size of T&D storage is commonly over 1 MW. In contrast, residential BTM systems are usually 5-15 kW. Therefore, the residential BTM category should be capped at 15 kW so that larger BTM storage, which has economies of scale, does not muscle out small residential storage. DOER should reconsider revisiting this cap as the program and markets develop.

A sub-target for BTM storage will ensure that Massachusetts achieves a diversity of sites for storage systems as well as a diversity of business models. This will increase energy security and resiliency and allow for robust competition amongst many manufacturers and suppliers. Without a sub-target for BTM storage, the Commonwealth would likely experience a glut of homogenous, large storage systems which would stifle innovation by not allowing for specialized business models and use cases.

Studies[5] show that customer-sited, behind-the-meter energy storage can technically provide the largest number of services to the electricity grid. BTM storage can provide customer services (backup power, increased PV self-consumption, time-of-use bill management, peak management, etc.), utility services (distribution deferral, transmission deferral, transmission congestion relief, resource adequacy, offsetting of peaker plants, and renewables integration) and even ISO services (energy arbitrage, spin and non-spin reserves, frequency regulation, voltage support, and black start).[6]

While storage has grown in the US market, residential developments have lagged behind. Customers (and DER aggregators) respond to incentives and rate structures, and will act to optimize the system only when properly compensated. Recognizing that the attributes of customer-connected storage are untapped and as the market develops and suitable compensatory mechanisms are established for grid and utility services, it is imperative that DOER incent a mass deployment of residential storage units with the future capabilities to provide these services when the markets are ready – and to help drive that market development.

Stakeholders and policymakers in Massachusetts will continue to develop tariffs and programs to maximize BTM storage. In parallel, targets and incentives are critical to driving deployment of smart BTM storage with the technical capabilities to provide

[5] Fitzgerald, Garrett, James Mandel, Jesse Morris, and Hervé Touati. The Economics of Battery Energy Storage: How multi-use, customer-sited batteries deliver the most services and value to customers and the grid.
Rocky Mountain Institute, September 2015. <<http://www.rmi.org/electricity_battery_value>>
[6] Page 6, Ibid

services to save all ratepayers money. BTM storage essentially represents private investment in the electrical grid that provides unique benefits to the entire system.

DOER should further reserve 50% of the BTM storage for residential customers. Residential customer-sited storage is optimally located to provide an important energy storage service: backup power. Currently, residential customers have less market structures available to them than do commercial and industrial customers. Therefore, for a widespread adoption of residential BTM storage, a 50% carve out is essential. Then, the market rules will efficiently develop for residential BTM storage participation as developers seek additional revenue streams.

In order to ensure smart deployment, residential systems should be required to benefit the grid immediately, by cycling the battery for purposes other than backup only. They should also be forward compatible for potential future aggregation and participation in markets. Finally, they should have, at minimum, a 10-year useful life and 2,000 cycles and be installed with secure communications and established connectivity to enable aggregation and remote setting updates for:

- scheduled battery utilization and dispatch
- grid-supply operating periods
- self-supply mode operating periods
- advanced inverter functions

Establishing minimum technical requirements for small systems will drive deployment of efficient residential storage and encourage innovative business models to develop, e.g., fleets of time coordinated or dispatchable virtual power plants.

Residential systems have the flexibility to provide many different services, depending on which is most economically efficient. For example, a residential storage system designed for backup power could provide the customer with the choice to consume grid electricity during periods of low system demand or could charge the storage for consumption on-peak, depending on market signals. With proper incentives, storage paired with smart inverters could provide voltage support, peaking capacity, and frequency response for the grid. These capabilities could enable distribution and power system upgrade deferral. A storage device could help customers manage their time-of-use rates and reduce peak demand for the system.

In addition, as more residential ratepayers invest in self-generation, residential storage will provide capacity expansion beyond the current built infrastructure, without the need for rate-based spending.

In illustration, we recommend the following:

Point of Interconnection	Proposed Targets	
Transmission and distribution connected	300 MW*	
Customer-connected Behind the meter storage		300 MW* (with at least 150 MW* reserved for residential storage)

* Allocated based on load ratio share among load serving entities

Utility Ownership

LSEs should not be able to own BTM storage, which would put competitive free-market companies at a disadvantage. In addition, because competitive companies cannot rate-base assets, allowing LSEs to own BTM storage would keep the costs of this storage artificially high and not drive the greatest ratepayer benefit, and even drive up retail electricity rates. By contrast, when private, third-party companies compete in the marketplace, the greatest efficiency is achieved for all ratepayers. Further, third-party providers drive more rapid adoption and deployment than utilities. Therefore, only ratepayers and third-party companies should be able to own BTM storage. In addition, third-party or ratepayer owned BTM storage can be aggregated and receive dispatch signals or autonomously respond, making the most economic and efficient use of the asset, without utility control.

Utilities have direct access to customers and branding advantages over third-party installers, presenting barriers to entry and stifling innovation from private companies. This raises the possibility of market manipulation to prevent competition. Also, in the absence of a current market for customer provided grid services, utilities may use storage as a distribution system optimization tool and reduce the customer's ability to save on energy bills and store energy for backup. Utilities should instead focus on developing rate structures and creating incentives for grid optimization.

Additionally, neutral and easy access to data in a useable format regarding how storage systems are performing will be critical to determining the success of the Commonwealth's storage program. Access to data will also help to illustrate the most efficient use cases and drive innovation. DOER should, at the outset, provide for robust data transparency.

Procurement Mechanism

DOER should further specify the procurement mechanisms for each market segment. An annual storage solicitation for T&D connected storage should use a standard contract and solicitation protocols. A competitive solicitation will ensure that LSEs can avail themselves of the best prices in the market. The LSEs should have the flexibility to specify the size of the storage and the interconnection point based on their need.

An incentive mechanism, instead of a competitive solicitation, should be used for BTM storage, similar to California's Self-Generation Incentive Program (SGIP). SGIP reserves 75% of the incentives for BTM storage with a carve out for residential storage. The SGIP program provides rebates for qualifying distributed energy systems installed on the customer's side of the utility meter. Residential energy storage receives a rebate level of $0.50/Wh, which gradually steps down, which has driven deployment.

In Conclusion

Due to DOER's vision and hard work, Massachusetts will soon be a national leader in energy storage. Companies are already pipelining investment and projects for the state pending final action on storage policy. This will create an ecosystem in Massachusetts for innovative business models, technology offerings, and more advanced market structures that will benefit the entire ratebase. We appreciate DOER's consideration of these comments and look forward to an ongoing discussion of energy storage in Massachusetts.

Sincerely,

Chris J. Rauscher, Director of Public Policy

Megha Lakhchaura, Director of Public Policy

Evan Dube, Senior Director of Public Policy

SOVEREIGN
ENERGY

Judith F. Judson
Commissioner
Massachusetts Department of Energy Resources

RE: Comments regarding appropriate structure and scale of energy storage targets in Massachusetts

Dear Ms. Judson,

The purpose of this letter is to voice Sovereign Energy Storage's support for a procurement mandate for Massachusetts utilities to require at least 600 MW of energy storage, and for those projects to be in commercial operation by January 1, 2020.

600MW Installed Capacity by 2020 is Reasonable

Based on our experience with the California energy storage procurement process (through the California Investor Owned Utility solicitations required by Assembly Bill 2514 "Storage Mandate) Sovereign is believes that a 600 MW target by January 1, 2020 is both achievable and reasonable. The process to install a transmission-connected energy storage project (larger than 20 MW) would take about 18 months. The longest-lead item in the development cycle is expected to be the ISONE interconnection study under the Large Generator Interconnection Process, which we expected to take twelve months. Sites can be prepared for construction in a matter of 4 – 5 months, and an 80 MWh order would require a 2 - 4 month lead time from a leading battery manufacturer. Smaller projects would take significantly less time, since the Small Generator Interconnection Process through the ISONE requires 6 months. Distribution connected projects require significantly less time with a 50 – 70 day interconnection turn-around time. As an example, due to the shutdown of Southern California Edison's (SCE) Aliso Canyon gas storage facility, SCE launched an RFP in mid-August 2016 to bring projects online by the end of 2016. SCE worked with developers and the California Independent System Operator to fast-track the interconnection of projects through this program. As a result, SCE was able to get a 50 MW, 200 MWh on-line by the end of 2016 through this program.

Projects Can be Built Quickly

If the interconnection processes can be streamlined, energy storage projects can have a rapid development cycles as:

1. Land requirements are minimal: a 20 MW, 80 MWh project can be sited on a 1 acre parcel
2. Permitting requirements are relatively straightforward: projects can be sited inside of existing warehouses or on commercial/industrial land
3. Equipment: there is a large market of battery manufacturers are eager to supply projects that are contracted with utilities

Existing Utility Programs & BTM To Count Towards Target

Sovereign also recommends that energy storage projects interconnected behind the meter at Massachusetts utility customer sites, whether procured through formal auction processes or incented by other regulated payment streams, be counted towards the procurement mandate. This will incentivize the utilities to grow programs whereby independent developers can use funds to provide

SOVEREIGN
ENERGY

economic benefits to rate-payers. These projects will also provide service to the grid by lowering customer peaks. In California, the IOUs have embraced the Self Generation Incentive Program (SGIP), which allows projects to earn revenue through both up-front and performance-based incentives from the utility, because they were able to claim credit towards their requirements in the Storage Mandate for each kilowatt installed under the program in their service territory.

Sovereign, along with many peers in the energy storage industry, will dedicate time and resources to help Massachusetts accomplish its clean energy goals through an energy storage mandate.

The mandate will lead to the development of a portfolio of distribution and transmission connected energy storage projects to provide capacity, energy, and ancillary services to the Massachusetts utilities and ISO New England.

Sincerely,

Brandon

Brandon J Keefe
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necec
Your Partner in the Clean Energy Economy

January 27, 2017

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

Re: Setting appropriate targets for viable and cost-effective energy storage systems

Dear Commissioner Judson:

Thank you for the opportunity to comment on the scale, structure, and mechanisms for energy storage system targets, pursuant both to Chapter 188 of the Acts of 2016, Section 15, as well as the Department of Energy Resource's ("Department" or "DOER") December 27 prudency determination. The Northeast Clean Energy Council ("NECEC") and our member companies are extremely appreciative of this decision regarding the merit of setting energy storage targets for the state, and we accordingly want to thank the Department and Baker Administration for their leadership in helping kick-start the burgeoning energy storage industry in Massachusetts. NECEC now looks forward to working with DOER to design and structure the most optimal storage target for the Commonwealth's residents and businesses.

NECEC is the lead voice for hundreds of clean energy companies across the Northeast, helping to grow the clean energy economy. NECEC's mission is to create a world-class clean energy hub in the region delivering global impact with economic, energy and environmental solutions. NECEC is the only organization in the Northeast that covers all of the clean energy market segments, representing the business perspectives of investors and clean energy companies across every stage of development. NECEC members span the broad spectrum of the clean energy industry including advanced energy storage, as well as solar, energy efficiency, renewable energy, CHP, fuel cells and advanced and "smart" technologies. Our members are already – or are very interested in – doing business in the Commonwealth and helping to grow the clean energy economy.

Overview

With the Department's commendable determination in favor of setting energy storage targets last month, NECEC believes that the Commonwealth is now well situated to incite an extraordinary surge in advanced energy storage[1] deployment and unlock a myriad of economic, energy, and environmental benefits promised to both ratepayers and the electricity system. As we argued in our comments to DOER on December 16, 2016, the storage target(s) is the key that will open up this tremendous opportunity for the Commonwealth, serving as the overarching framework for the enabling regulatory regime of related policies and programs that will take shape within the target's parameters.

With these comments, NECEC is glad to provide recommendations to the Department for

[1] Here and throughout these comments, references to "energy storage," "storage," and other variations thereof refer to the definition of advanced energy storage adopted by the *State of Charge* report, including flexible technologies such as batteries, flywheels, thermal, and compressed air energy technologies and excluding conventional storage technologies such as pumped hydro.

appropriately designing the scale, structure, and mechanism of the storage targets. We believe that closely calibrating the targets to these guidelines will secure for Massachusetts a local energy storage industry with all the hallmarks of a vibrant emerging market: robust competition, demonstrated success across a diversity of use-cases and applications, and substantial experience and learning for developers, electric companies, and policy-makers alike. These comments reflect input from NECEC's member companies and conversations with other stakeholders across the clean energy and energy storage spaces. We hope that the Department will find these initial recommendations valuable, and we look forward to engaging in further discussions about the design and structure of Massachusetts' storage targets in the coming weeks and months.

Establish an Ambitious, but Achievable Target

NECEC recommends that the Department set a mandatory statewide energy storage target of 600 MW contracted or installed by 2020, including a 50% mandatory sub-target for behind-the-meter (BTM) systems. We are confident that the energy storage industry is able to meet and exceed this ambitious target. Taking bold action is well justified by the opportunity for savings and benefits storage can bring to customers and the electricity system as a whole. We present the following comments to lay out our specific recommendations for the targets and offer a roadmap for successful implementation and achievement.

Compliance with Energy Storage Targets Must Be Mandatory

In designing energy storage targets for the state, the Department must first decide whether the targets for electric companies are to be mandatory and fully binding or merely aspirational and voluntary. NECEC strongly recommends that the targets DOER develops and implements *must* be mandatory in order to adequately signal market certainty and spur the level of investment needed to guarantee competition, use-case diversity, and wide-ranging experience. NECEC has heard resoundingly from our members that any voluntary targets would be insufficient for driving storage deployment at a magnitude even remotely comparable to the hundreds of megawatts (MW) modeled and analyzed by the *State of Charge* consultant team. With so many benefits on the table for Massachusetts customers, a voluntary target would jeopardize the tremendous value and savings that storage can provide. NECEC urges the Department to set a target that is worth setting: one that must be complied with.

So, what will compliance with a binding, mandatory target actually look like in practice? In its directives to the Department, Chapter 188 of the Acts of 2016[2] made clear in Section 15(c) that "each electric company entity shall submit a report to the department of energy resources demonstrating that it has complied with the energy storage system procurement targets...." As formulated, the statutory obligation to file such a report will provide the impetus for electric company compliance with whatever targets the Department sets. This report can and should be backed by alternative compliance payments or other penalties for non-compliance to ensure that the obligation imposed through the target is met. In addition to reporting and confirming target compliance, the report can also serve as the vehicle for communicating to the Department all data about the storage deployment achieved in a given service territory by January 1, 2020, including breakdowns by use-case and ownership model and information on price trends.

[2] Available online at https://malegislature.gov/Laws/SessionLaws/Acts/2016/Chapter188.

Less clear in the statute is what exactly constitutes 'achievement' of the targets. Section 15(a) describes the setting of targets "to be achieved by" January 1, 2020. To resolve any uncertainty about the meaning of this phrase, NECEC recommends that the Department adopt a broad definition of target achievement to count both projects that are installed and in-service as well as projects that have secured contracts prior to the target deadline, with the added requirement that the latter group of projects be installed prior to January 1, 2022. As such, our recommendation is to define the targets as "procure by" rather than "install by." For an initial book-end, however, we would recommend that storage projects must be installed after January 1, 2017, to count for compliance with the 2020 target.

This definition is a recognition of the relatively short time frame of less than three years between the setting of the targets this year and the January 1, 2020 deadline, and of the comparatively long development cycle for many projects and use-cases. Including a buffer for projects that cannot achieve commercial operation by January 1, 2020 will open the door for many more projects to qualify under the 2020 target and will not prematurely preclude the participation of any use-cases with long development cycles or requiring major enabling policy changes to take effect. For any MWs that are contracted for but are unable to reach commercial operation by the backstop of January 1, 2022, we would recommend that the Department automatically roll-over un-built capacity into the targets for subsequent years (e.g., 2025, 2030).

Lastly, as we elaborate in further detail below, we believe that compliance with the target should be mandatory for the state's electric distribution companies. While we are eager to see the Department push strongly for participation in the program by Municipal Light Plants (MLPs), competitive retail suppliers, and other load-serving entities (LSEs), we feel that EDC compliance offers the simplest and most realistic option for setting and implementing the compliance obligation. While there would be no compliance burden on competitive retail suppliers, any storage owned/operated by a supplier (whether in front of, or behind the meter) would count towards the target for the distribution company in whose service territory the system is located. And, as a complement to the EDC target, a robust program for voluntary participation from MLPs could be developed to drive additional deployment, as MLPs are fast-movers with a high likelihood of meeting or exceeding their *State of Charge*-estimated deployment thanks to a high benefit-cost ratio. Nonetheless, it would be most appropriate to restrict mandatory target compliance to the state's EDCs and develop a voluntary program for MLPs in parallel.

The Scale and Apportionment of the Energy Storage Target

NECEC submits its recommendation to the Department for an ambitious but eminently achievable statewide target of 600 MW of viable and cost-effective energy storage by 2020. Additionally, we recommend a sub-target or minimum carve-out of 50% for behind-the-meter (BTM) systems, with front-of-meter (FOM) deployment likely to make up the bulk of the remaining 50% of compliance. As part of this recommendation, NECEC reiterates its suggestion that electric distribution companies (EDCs) be barred from owning systems interconnected BTM (discussed in more detail below). With respect to FOM storage, competition among a variety of ownership and business models should be encouraged. Utility owned storage, while beneficial, should be focused on locations and applications not served or less likely to be served by competitive third-party suppliers. While NECEC is not recommending a specific limit on utility ownership of FOM storage, 50% might be a reasonable benchmark or guide. This would place utility storage ownership – or more precisely, utility ownership counted for compliance with the target – at around 25% of both statewide and individual company targets.

Drawing from the most recently available distribution load data for the state's electric distribution companies,[3] we present the following illustrative apportionment of the statewide 600 MW target:

Figure 1: Illustrative Apportionment of Statewide 2020 Target by EDC

Distribution Company	2015 Distribution Load (MWh)	Target Share (%)	Target Share (MW)
Massachusetts Electric	*21,750,244*	*45.3%*	***271.8***
BTM Sub-Target			*135.9*
Nantucket Electric	*176,717*	*0.4%*	***2.4***
BTM Sub-Target			*1.2*
NSTAR	*21,896,222*	*45.6%*	***273.6***
BTM Sub-Target			*136.8*
WMECO	*3,708,396*	*7.7%*	***46.2***
BTM Sub-Target			*23.1*
Unitil	*476,026*	*1.0%*	***6***
BTM Sub-Target			*3*
Statewide 2020 Target	*48,007,605*	*100.0%*	**600**

The rationale for setting the 2020 target at 600 MW is based on several factors. This target first of all codifies the 600 MW benchmark targeted by the suite of policy recommendations included in *State of Charge*. We believe that the state should push to accelerate this target from 2025 to 2020 in order to realize a greater portion of the benefits from the 1,766 MW that the report stated "would maximize Massachusetts ratepayer benefits" by 2020.[4] Many of the 1766 MW identified may not be in service in the 2020 timeframe due to existing regulatory and market obstacles, but specifying a hard "commercial operation" deadline of 1/1/2022 will allow a sufficient amount of projects to be contracted and constructed for compliance under the 600 MW 2020 target.

Furthermore, we have heard from many of our members that deployment in particular use-cases is likely to significantly exceed the use-case estimates included in *State of Charge*.[5] In particular, hardware and platform developers in the BTM and residential storage spaces indicate that the benefit-cost ratio and megawatt projections included in the report fall short of the considerable value and potential for deployment in these applications. This divergence of opinions affects the valuation of third-party (non-utility) dispatch and aggregation and BTM systems' ability to provide distribution services and participate in wholesale markets. Increasingly, companies in our membership and the industry are competing with offerings to manage and dispatch a fleet of distributed BTM storage assets as a "virtual power plant." This creates the ability to tap into additional revenue streams and strongly enhance the benefit-cost ratio of these particular use cases. We expect that such deployment will flourish after targets are set and the accompanying policies and programs are implemented.

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[3] Based on data provided by DOER staff on 10/26/2016 in discussions with Working Group #2 in the Fall 2016 stakeholder process for the solar incentive successor program.
[4] *State of Charge,* p. xi.
[5] Ibid., p. xvi.

More broadly, our recommendation for a statewide 2020 storage target of 600 MW is based on indications that the storage industry is ready to step up to the plate to meet and exceed an ambitious target in Massachusetts. The industry has matured tremendously over the last five years of experience with the California target, and the knowledge gained to date affords Massachusetts the advantage of 1) not having to reinvent the wheel; 2) replicating multi-year proceedings in a matter of months; and 3) being able to avoid known pitfalls and dead-ends along the way. Combined with ongoing reductions in hardware costs, these advantages will allow Massachusetts to exceed the deployment achieved in the first three years of the California program (after adjusting for market-size). Considering all of this, we urge the Department to strive for an ambitious level of deployment through a target of 600 MW.

The Behind-the-Meter Sub-Target

To preserve robust competition across the full spectrum of use cases, DOER should build in to the statewide target mandatory sub-targets for behind-the-meter deployment. These sub-targets would represent the *minimum* amount of BTM deployment needed for compliance with the 2020 target, and BTM capacity in excess of these sub-targets would be countable for compliance with the non-BTM target capacity. Structuring these sub-targets as such will avoid unintentionally foreclosing any options and use cases at the outset of the program. Remaining capacity under each electric company's target will be open and competitive, filled by a mix of utility and third-party owned FOM systems and any BTM projects in excess of the BTM sub-targets.

The justification for a distinction for the BTM domain is to prevent a small number of large projects from filling up all or most of the target and limiting participation from small, distributed BTM systems. In California, experience showed that a BTM carve-out was absolutely necessary: our members affirm that if there had not been a BTM carve-out, it was clear that utilities would have been likely to opt for a handful of large grid-scale procurements at the transmission and distribution level. (California ended up with three domains of transmission, distribution, and customer, but the distinction between transmission and distribution was rendered mostly meaningless by a provision allowing 80% switching between these domains.) Knowing that the smaller, distributed use cases would have been boxed out absent a carve-out or sub-target for customer-sided resources in California, it is critical for Massachusetts to include this protection to ensure market access to the full range of BTM use cases.

NECEC believes strongly that the BTM sub-target should be set at at least 50% of the target implemented by DOER. This will first and foremost allocate a sufficient amount of MW to meaningfully test the full range of BTM applications and use cases, including residential. While most grid-connected batteries derive value from delivering a single, primary service, BTM systems have the greatest potential for multi-use and can provide the maximum number of different value streams to customers and the electric grid.[6] As a direct result of this inherent ability, the BTM market segment will have the widest range and diversity of applications and business models, and therefore the potential to provide the greatest value to ratepayers. In the residential sector, the coming years will bring major changes to net metering, the adoption of time of use rates, and new technologies that enable residential-level energy storage systems to be easily aggregated and deployed for demand response. With this in mind, NECEC recommends that DOER *not* set any minimum storage system size that would prevent residential and small commercial customers from realizing the benefits of behind-the-meter

[6] "The Economics of Battery Energy Storage," from the Rocky Mountain Institute (RMI). Available online at http://www.rmi.org/electricity_battery_value.

energy storage. Outside of this protection, much progress remains to be made to set up the market and policy mechanisms needed to allow BTM systems to reap benefit from the multiple services they can provide. A sub-target for BTM deployment will thus not only enable the changes needed to unlock the highest value use cases and models but also provide protection for BTM use cases until such time as the mechanisms are fully implemented.

Finally, as stated previously in these comments, NECEC reiterates its position that electric distribution companies should be barred from owning[7] BTM energy storage systems, both generally and with specific reference to compliance with the storage targets under consideration. Importantly, the 2016 Energy Diversity Act provided needed authorization for EDC ownership of energy storage systems, and opening up some percentage of the market for utility-led development and ownership is important to ensure the ability to deploy storage where it can meet system needs and add value for customers. However, we believe it is important to preserve the meter as the end-point of distribution companies' reach on the distribution system. This would ensure that distribution companies would not be able to take advantage of existing customer relationships in a domain that can and will be adequately served by a robust, third-party market. Ownership behind-the-meter would undermine the integrity of the market that the state seeks to incite with the setting of storage targets. Therefore, DOER should prohibit distribution company ownership in BTM use cases and applications.

Achieving Compliance: Programs, Policies, and Solicitations for Meeting the Target

The storage target set by DOER should capture the full spectrum of policy and program-driven deployment available to the market. In other words, storage deployed in a variety of settings – ranging from peak demand reduction projects utilizing energy efficiency funding to projects qualified under the state's successor solar incentive program – should count towards compliance for the 2020 target, provided that projects fall within the appropriate window (installed after January 1, 2017 and before January 1, 2022). All 600 MW of the target would not, as a result, need to be directly procured by electric distribution companies for compliance; a company would instead be able to count all storage projects located in its service territory that meet the installation-date and technology requirements for compliance with the target.

The list of possible avenues to deployment and compliance is quite lengthy, and harkens back to the policy recommendations offered in *State of Charge*. Such avenues include, but are not limited to:

- Funding from Three-Year Energy Efficiency Plans, including peak demand reduction programs;
- Alternative Energy Credit (AEC) revenues from qualification in the Alternative Portfolio Standard (APS);
- Incentives received under a "MOR-Storage" rebate program, akin to the California Self-Generation Incentive Program (SGIP);
- Funding from the Commonwealth's Community Clean Energy Resiliency Initiative (CCERI);
- Qualification under the state's successor solar incentive program and revenue from the planned "storage adder";
- Future pilots and solicitations issued by DOER, Executive Office of Energy and

[7] Utility *dispatch* of BTM assets is a separate question, and we feel that this ability should be preserved with appropriate opt-in protections and consumer education.

Environmental Affairs (EOEEA) sister agencies, or other state departments (e.g., the Division of Capital Asset Management and Maintenance, DCAMM), including those for microgrid development;

- EDC procurements for systems proposed in rate cases, demonstration pilots, grid modernization plans, clean energy generation solicitations, and other proceedings;
- Procurements specially issued by EDCs for compliance with the target, including RFPs/RFOs for EDC ownership, build & transfers, third-party offers with dispatch control, and other models.

These avenues present an array of opportunities for storage deployment, but each will have a unique implementation timeline. Some avenues, such as CCERI grant funding, will need little to no enabling action on the part of regulators or utilities to bring about storage deployment. Other avenues will present significant deployment opportunities in the near term after modest enabling efforts, such as the successor solar incentive program and a MOR-Storage program. A MOR-Storage program, structured simply and in-line with California's Self Generation Incentive Program (SGIP), is one example of a brand new mechanism that could be designed and launched in a matter of months. Other initiatives like including storage in the APS and integrating robust peak demand reduction funding under Three-Year Energy Efficiency Plans will be on slightly longer implementation horizons, but their enablement can be achieved for impact on the 2020 target if pursued in earnest. Many of our members are particularly excited about building on a well established, "blue ribbon" regulatory program like energy efficiency, whose cost-effectiveness accounting and familiarity in other New England states will facilitate quicker and wider adoption of energy storage mandates in Massachusetts and across the Northeast.

These avenues alone may not constitute a viable pathway to 600 MW of storage in less than three years, so we expect that any target capacity unmet by these policies and programs would be met by EDC procurements and solicitations. On top of proposals for deployment included in existing forums such as rate cases or grid modernization plans, utility procurements could take the form of Requests for Proposals (RFP) or competitive Requests for Offers (RFO), which California PUC Commissioner Carla Peterman reported has emerged as the most common method in California.[8] Should the Department want to prescribe a structure for the solicitations, it might consider requirements that build in minimums for solicitations seeking third-party offers (e.g., a minimum of 25%, either by solicited capacity or by number of solicitations). Transparency into utilities' evaluation of bids received, including modeling and/or cost-effectiveness testing performed or use of an independent evaluator if utilities themselves are proposing projects, will be important to preserve as the Department and the industry assess and respond to distribution companies' requests and preferences.

One important final recommendation relating to utility procurements would be a requirement for EDCs to submit a plan for reaching their allotted target within 180 days of the Department's target decision. This plan, which could be called a Storage Deployment Plan (SDP), would include details about the types and size of planned solicitations, expected amounts of eligible storage from new programs such as the APS or successor solar incentive, and other mechanisms and plans for achieving compliance with the 2020 target. Companies would not be required to stay in line with the exact plan in their actual deployment and compliance through 2020, but an SDP would allow the Department to evaluate whether companies have developed a reasonable path to target achievement at the outset and recommend adjustments/revisions as

[8] As paraphrased from Commissioner Peterman's remarks to the Restructuring Roundtable on December 9, 2016.

necessary.

Recommendations for Setting 2025 and 2030 Targets

While the focus of the decision at hand is setting the targets for 2020, NECEC urges the Department to consider establishing preliminary targets for 2025 and 2030 in this process. An early proposal for the targets in these years will send a signal to the industry and market about the long-term certainty and stability of the Massachusetts storage market, even if the targets may be adjusted after the three-year reviews mandated in the statute.

While the particular level of the targets for 2025 and 2030 deserves further discussion, the Department could consider seeking to double the 2020 target by 2025 (e.g., reach 1200 MW) or instead codify the 1766 MW of storage optimized for ratepayer benefit in *State of Charge* as the 2025 target. Borrowing from the example of solar development in the Commonwealth, we would simply recommend that storage targets for 2025 and 2030 reflect what is likely to be non-linear growth in the intervening years. Once again, the critical benefit achieved by setting targets, however preliminary, for 2025 and 2030 is to signal some level of certainty and predictability to the market. Accordingly, NECEC urges the Department to consider setting targets for such later years in the near future, if not as a part of the current process.

Conclusion

NECEC is grateful to the Department for its consideration of these comments. We look forward to continuing to work with DOER and other stakeholder to set appropriate targets for energy storage adoption, which will propel Massachusetts to the forefront of energy storage leadership. If the Department would find it helpful, we would recommend that it schedule one or more technical sessions with stakeholders this spring to build consensus on, among other considerations, the optimal pathways to target achievement and to begin preliminary development of EDC storage deployment plans.

We would be glad to discuss any of our recommendations with DOER and reiterate that we are available as a resource throughout this process. Please do not hesitate to contact us if you have any questions or we can provide any assistance.

Sincerely,

Peter Rothstein
President

Janet Gail Besser
Executive Vice President

Cc: Will Lauwers, DOER
Jamie Dickerson, NECEC
Alistair Pim, NECEC

January 27, 2017

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

RE: Evaluation by Department of Energy Resources to Implement an Energy Storage Procurement Target

Dear Commissioner Judson:

Alevo USA Inc. ("Alevo" or the "Company") appreciates the opportunity to provide Comments in the above-referenced matter. The Massachusetts legislature (An Act Relative to Energy Diversity, Chapter 188 of the Acts of 2016) has directed the Department of Energy Resources ("DOER") to determine whether it would be prudent for them to evaluate an energy storage procurement mechanism as a policy matter. The Department of Energy Resources ("DOER") on December 28, 2016, determined that it is prudent for the Commonwealth to set targets for energy storage systems. As detailed herein, given the DOER's determination that energy storage systems targets are prudent, Alevo respectfully provides feedback in consideration of the target scale, structure and mechanisms for energy storage systems targets.

ABOUT ALEVO

Alevo is a manufacturer, project developer and systems integrator of lithium-ion batteries with experience installing grid-scale battery projects in the United States. Alevo employs more than 200 people in its Concord, North Carolina, factory. Alevo's corporate office is in Switzerland and manages research and development in Germany.

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COMMENTS

Question: What are the appropriate target scale, structure and mechanisms for the energy storage systems target?

Target Scale

DOER should set a 600 MW energy storage target with the expectation that 400 MW can be deployed and operational by January 1, 2020. Alevo recommends that this amount be a floor and not a target, since the *State of Charge* report found that in excess of 1,700 MW of energy storage would be cost effective for Massachusetts ratepayers. The *State of Charge* Report determined that a no-regrets 600 MW target would provide $800 million in cost savings to ratepayers and result in a GHG reduction of 350,000 metric tons over a 10-year period.[1]

DOER should, however, avoid instituting a MWH component for the target because, as found in the *State of Charge* report, the optimal energy storage duration is specific to use case and location.[2] By avoiding a MWH target, DOER will ensure that utilities have the flexibility to deploy the optimal mix and types of assets for the benefit of Massachusetts' electric customers.

If DOER decides that a MWH component is necessary, it should rely on the *State of Charge* finding that preferred short duration, high power energy storage systems over lower power, higher duration systems. "The use of short duration, high power energy storage, where feasible, will result in a lower cost and higher flexibility of the electricity system. Energy duration of the [short duration] storage can be extended by decreasing the power output for given installation of MW/MWH."[3]

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[1] *State of Charge Report*, page xvi
[2] See 1, page 85
[3] See 1, page 85

Target Structure

Alevo recommends that each utility be given a specific target with non-recoverable penalties for non-compliance, based on each utility's share of statewide coincident MW for the year ended 2016.

Each utility, however, should have the flexibility to determine the optimal location for energy storage systems on their grids. As demonstrated in the State of Charge report, the value of energy storage depends highly on its location. And so utilities should have the flexibility to prioritize the optimal location areas on their systems for energy storage systems. For those reasons, Alevo recommends that DOER avoid specific storage use cases and allow utilities to determine the optimal location on their systems.

If DOER mandates specific use cases, Alevo respectfully recommends that utilities have the opportunity to change how energy storage systems are allocated if they can demonstrate why it is prudent for them to do so.

Because utilities are held accountable for reliability and have the obligation to serve all customers, DOER should ensure that the utilities have the opportunity to own and operate all energy storage systems. This is not only more cost-effective since it enables the direct sale of energy storage systems and equipment, but will ensure that Massachusetts ratepayers benefit from seamless operation of those resources. It will also ensure that DOER and the Department of Public Utilities ("DPU") continue their oversight of energy storage systems deployed in the Commonwealth.

Energy Storage Target Mechanisms

In order to maximize the benefits of energy storage technology for Massachusetts electric customers, policymakers and utilities should fold energy storage target achievement into the Grid Modernization Planning process. This ensures a holistic analysis of each system, so that utilities and stakeholders can evaluate the optimal use cases and locations for energy storage resources. This fits squarely with the intent of the Grid Modernization Planning process, whose objectives are to 1) reduce the effects of outages; 2) optimize demand; 3) integrate distributed resources; and 4) to improve workforce and asset management.[4]

As outlined in the *State of Charge* [5] report, several utilities are already utilizing the Grid Modernization planning process to deploy energy storage technologies, including Eversource, which recently proposed a $100 million investment in energy storage technologies as part of its

[4] Grid Modernization Plan Straw Proposal. D.P.U. Docket 12-76-A, page 3
[5] See 1, page 50

latest Grid Modernization Plan.[6] Over time, a recommended improvement to the plan would be to evaluate how energy storage technologies may reduce the need for more conventional investments. That said, Alevo applauds the level of detail and analysis provided by Eversource in its plan, and believes it represents a good start toward how utilities can evaluate the deployment of energy storage in a holistic manner.

For behind the meter applications, Alevo recommends that energy storage be incorporated into existing utility energy efficiency programs, where the technology can be utilized as a peak-shaving asset, among other uses.

Flammability

In addition to use case and duration, Alevo recommends that DOER and DPU consider battery flammability in setting standards for battery storage within the state. Given the likelihood of batteries being installed in urban population centers, adjacent to critical infrastructure, and even within buildings themselves, it would be prudent for DOER to consider the flammability of energy storage devices to be deployed due to the well-documented risks of certain battery chemistries, particularly in light of the recent, high-profile recalls of certain consumer electronics and personal transportation devices due to battery fires.

[6] See D.P.U. 17-05

Conclusion

Alevo thanks the DOER for the opportunity to respond to the stakeholder questions asked by DOER on December 28, 2016, and looks forward to participating in the stakeholder process going forward. Please do not hesitate to contact me with further questions.

Respectfully Submitted,

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January 27, 2017

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

JOINT COMMENTS OF ADVANCED MICROGRID SOLUTIONS, GREEN CHARGE NETWORKS, AND STEM REGARDING THE DESIGN AND IMPLEMENTATION OF AN ENERGY STORAGE TARGET IN MASSACHUSETTS

Dear Commissioner Judson:

Summary

In order to effectively incentivize the storage market in Massachusetts, Advanced Microgrid Solutions ("AMS"), Green Charge Networks ("Green Charge"), and Stem, Inc. recommend that, the scale of the Massachusetts Energy Storage target be ambitious and attainable, that the structure is flexible and simple, and that the deployment mechanisms begin as early as possible. Specifically, we recommend a target of 750 MW procured across all load serving entities by 2020 pursuant to plans developed by each entity and divided evenly between customer and grid sited projects. This will be achievable with immediate implementation of incentive mechanisms to jump start energy storage installations.

Background

On December 28, 2016, the Massachusetts Department of Energy Resources (DOER) determined that it was prudent for the Commonwealth to set targets for electric companies to procure viable and cost-effective energy storage systems by January 1, 2020. The DOER is also required to consider, "a variety of policies to encourage the cost-effective deployment of energy storage systems" and must adopt energy storage systems targets by July 1, 2017. The DOER is specifically seeking comment on the following topics: 1) The appropriate target scale, 2) Target structure, 3) Mechanisms to achieve the target.

AMS, Green Charge, and Stem appreciate the opportunity to provide feedback and support regarding the scale, structure, and implementation mechanisms of the upcoming Energy Storage Procurement Target. With the December 28th decision, Massachusetts took an important step in establishing the Commonwealth as a national leader in energy storage. This decision builds upon the forward-looking research presented in the DOER's State of Charge report and the Commonwealth's history of clean energy leadership. We look forward to working with the DOER, Energy Delivery Companies ("EDCs") and Load Serving Entities ("LSEs") to bring the energy storage target to fruition.

Introduction to AMS, Green Charge, and Stem

Together AMS, Green Charge, and Stem account for an estimated 80 + percent of the national behind-the-meter (BTM) energy storage market. As industry thought leaders, with megawatts ("MW") currently deployed across the country, we bring our collective experience and expertise to support our recommendations on the scale, structure, and mechanisms of the Massachusetts target.

Advanced Microgrid Solutions ("AMS") is pioneering the use of distributed energy storage systems for electric utility grid support. With over 120 MW of customer-sited energy storage contracted and under development our aggregated energy storage systems provide electric utility grid support, while optimizing resource management, cost reduction and revenue generation for large-scale energy users. Using a technology-agnostic approach, the company designs, finances, installs and manages advanced energy storage solutions for commercial, industrial and government building owners. AMS's unique management software then turns these individual storage systems into a fleet that provides a suite of real-time services to grid operators and utilities.

Green Charge Networks ("Green Charge") is a national market leader in behind-the-meter energy storage, including projects in Massachusetts and New York in the northeast U.S. Founded in 2009, Green Charge has gained valuable technical and policy insights, having worked closely with numerous utilities and regulators in storage pilot programs, behind the meter storage program design processes, demonstration projects, and large-scale deployment partnership arrangements. In April 2016, Green Charge was acquired by ENGIE (formerly GDF Suez) the largest global independent power producer (IPP) and a major provider of energy efficiency and retail electricity across Massachusetts through subsidiaries OpTerra Energy Services and GDF Suez Energy Resources.

Stem is a national leader in developing, owning and operating intelligent energy storage systems for businesses. Stem systems are installed and interconnected at customer sites behind the utility meter and utilize advanced analytics to charge and discharge the storage devices for optimal economic benefit. With the industry's largest contract for aggregated energy storage systems and as the first energy storage aggregator to participate in California's real time wholesale energy market, Stem is breaking new ground in realizing the full potential of distributed energy storage to provide valuable grid services.

Guiding principles

To determine the most appropriate scale, structure, and implementation mechanisms for the Massachusetts Energy Storage Procurement Target we evaluated our experience with target policies in other states to develop the following principles to guide our recommendations.

First, the program should be designed to provide broad experience and maximize learnings across a wide range of energy storage applications. The target must be sufficient in scale and scope to attract multiple competitors in deploying storage in each application space, which in turn will accelerate learning and drive down costs. The target should signal that sufficient market size and stability exist to draw the required investment levels and employment opportunities needed to jump start the industry.

It is essential that the target assist in moving the Massachusetts storage industry beyond pilots into a market driven environment.

Second, given the short time frame in statute (approximately 2.5 years), simplicity is key. The target should avoid overly prescriptive structures regarding technology and domain, while still ensuring sufficient competition across sectors. Encouraging flexibility will aid utilities and storage developers in achieving target goals on the given timeline.

Third, the target should act as an umbrella policy that will spur development of policies and programs to provide further funding for deployment and specific rules for what qualifies in each use case. Specific procurement targets are important building blocks for the industry, but are insufficient alone to overcome all existing market barriers and drive industry development. A target will encourage relevant stakeholders to push beyond the status quo and evaluate where energy storage might improve existing operations.

Fourth, any procurement target or policies to encourage storage must value and encourage multiple use of the resource. Storage can simultaneously provide distinct and incremental services to the wholesale energy market, electric utilities (capacity, transmission & distribution deferral, various distribution level services), and in the case of BTM storage, to the end user (demand charge management, back-up power). Valuing and encouraging the battery resource to add as much value as possible increases benefits for ratepayers and reduces their costs.

Fifth, important lessons can be taken from other states' successes and failures in how to best design and implement an energy storage target. Massachusetts should seek to build upon these lessons to create an energy storage program that meets the unique needs of residents, businesses, government entities and ratepayers in Massachusetts.

Target Scale – Broad and Significant

AMS, Green Charge, and Stem recommend a Massachusetts Energy Storage Procurement Target of 750 MW to be procured by 2020. This recommendation is premised on the DOER's State of Charge report, which found that up to 1,766 MW of advanced energy storage, integrated into the state's grid across a variety of use-cases, would yield a net benefit to Massachusetts ratepayers.

Advanced energy storage provides unique value to the Massachusetts grid and ratepayers as noted in the State of Charge report. It can be sited quickly and in densely populated locations, while providing flexible, locational value to defer distribution or transmission upgrades. Storage plays an essential role in facilitating higher levels of renewable penetration through firming and load shifting. It has demonstrated success providing fast and effective voltage support, frequency regulation, and other location-specific grid services. Finally, it can contribute to grid resilience in a clean, cost-effective manner.

The 1,766 MW recommended by the State of Charge report would represent approximately 15% of Massachusetts' current peak load and approximately 14.5% of projected 2020 peak load. This

comparatively higher percentage than that adopted by California reflects the unique supply, demand, cost, and weather conditions facing the Commonwealth as noted in the State of Charge report. The report presents compelling in-depth cost-benefit analysis on the benefit of integrating up to 1,766 MW of advanced energy storage. The most pertinent question to this proceeding then becomes how many MW of energy storage the industry can realistically commit to on this short timeline.

The State of Charge report presents a suite of policies expected to deliver an estimated 600 MW. We believe these policies underestimate the ability of the industry to deliver MWs given the right market and policy conditions.

Since 2012 the storage industry has seen tremendous growth. In 2012 83 MW of energy storage were deployed in the U.S., while in contrast ~500 MW of advanced energy storage are projected to be deployed in 2017 alone. Advanced energy storage deployments are further projected to grow 35x over the next 5 years.[1] Moreover, the 2015 Aliso Canyon gas leak in Southern California demonstrated the ability of the storage industry to quickly mobilize deployments. In response to the Aliso Canyon emergency, Southern California Edison and San Diego Gas & Electric procured and installed more than 60 MW of energy storage in less than six months. As we evaluate industry capabilities to deliver MW in Massachusetts, it is important that we consider the rapid acceleration in storage deployments - looking forward, not backward at more nascent capabilities. Given the growth and maturity of the industry from 2010 to 2017, and consistent with the State of Charge report, there is ample evidence to support the industry's ability to deliver 750 MW for procurement by 2020. Our companies alone are currently deploying hundreds of MW across the country, much of that in California where our companies are providing ~200 MW to support the California storage target.

Foundational Recommendations

Our recommendation for the 750 MW target assumes the following as a foundation.

First, the target should be set in terms of *MW not MWh.* This distinction will encourage simplicity and flexibility. As storage use cases span both energy (MWh) and power (MW), a MW target will enable different applications to determine optimal duration for each use case. Moreover, it prevents the inefficiency of incentivizing systems that are longer in duration than needed for any particular application.

Second, it should be clarified that the target is mandatory, not voluntary, for all load serving entities. Given the existing market barriers facing energy storage, as detailed in the State of Charge report, a mandatory target is necessary to drive the industry forward and overcome these barriers.

Third, the definition of what constitutes "procurement" towards the target must be clear for all stakeholders. Common industry practice is for resources to count as procured by a utility company if

[1] Green Tech Media: "U.S. Energy Storage Monitor: Q4 2016"

the resource developer has executed a contract with the utility. Such resources do not need to be operational to count as "procured," but must be online by 2022.

For the purposes of a technology target, this definition should be expanded to include resources that are operational due to a program or tariff. The State of Charge report recommends several policy mechanisms and programs to incentivize the deployment of energy storage, and any storage installations that are operational as of the deadline due to these mechanisms should also count towards the procurement target.

To be clear, we do not recommend that *potential* storage capacity made available within programs or tariffs be counted unless that capacity is installed or contracted by the deadline. For example, megawatts authorized for the "storage adder" in the Next Generation Solar Incentive would not count until installed under that incentive. Similarly, megawatts eligible for Alternative Energy Credits under a revised Alternative Portfolio Standard would only count once the installations are registered to earn those Credits.

Fourth, the target should require that all storage be connected to Electric Distribution Company (EDC) or municipal grids, must be operating in parallel with the grid, not just for backup, to count towards the target.

Target Structure – Simplicity and Flexibility

In establishing the storage target, the DOER should seek to limit prescriptive design choices only to those that are necessary to preserve competition across markets and ensure broad participation. By keeping the rules simple, the entities subject to the target have the greatest flexibility in meeting it in the most cost-effective manner for ratepayers.

To this end, we recommend that Massachusetts recognize the primary industry segments and divide the target between 1) Customer-sited (i.e. behind-the-meter, or BTM) storage and 2) Grid sited (i.e. in-front-of-the-meter, or FTM) storage. The reasons for creating the "customer domain" in California hold true for the Bay State as well. Without a minimum allocation for BTM storage, the state risks the likely scenario that the entire target is met with a small number of large scale storage projects. LSEs will naturally prefer to procure FTM storage, as it aligns more closely with their existing business models, and thus an entire class of valuable storage applications could be "boxed out" of the state's energy storage revolution.

On the other hand, California's distinction between the distribution and transmission domains has not proven to be particularly meaningful. Regulators recognized this possibility early on, allowing the utilities to transfer up to 80% of the target megawatts from one domain to the other. It is unclear whether this structure has helped significantly in the diversity of projects. Thus, we recommend that the Massachusetts target be split between the BTM and FTM storage segments, allowing the LSE's maximum flexibility within those constraints.

With this division, the value and wider range of applications for BTM storage argues that the BTM category be no less than 50% of the overall storage target. The Rocky Mountain Institute study[2] on the uses of storage showed that BTM storage can provide the most value streams, the maximum (13) that are available. As such, the BTM market segment will have the widest range and diversity of application and business models and the greatest value to the grid and ratepayers. Without sufficient MWs guaranteed for the BTM segment, Massachusetts risks developing a narrow market.

Furthermore, the long-term portfolio of energy storage in Massachusetts will likely be dominated by BTM installations as the power system becomes more distributed. The "Utility of the Future" report[3] recently released by MIT, predicts the trend towards a distributed grid where more and more resources and control are decentralized towards the grid edge.

Finally, BTM storage has the potential to reap the greatest value for ratepayers due to the multiple services it can provide. We believe the State of Charge report, based on the timeline of research events, undervalued BTM storage due to the market and operational data becoming available too late to be incorporated into the analysis. With up-to-date data on BTM installations, the State of Charge report would have reached different conclusions. By limiting the analysis to less prevalent use cases and by failing to account for the grid services that aggregated fleets of BTM storage are already providing in California, the results valued substation-sited storage for example at a higher level than BTM storage. Since BTM storage can provide all the same services of substation-sited storage and then stack on customer value that can only be provided by behind-the-meter, logic suggests that BTM storage benefits should be no less than substation-sited storage benefits.

For all these reasons, BTM storage should be allocated no less than 50% of the overall storage target (i.e. 375 MW if the DOER adopts our overall target recommendation). And further, this "sub-target" should explicitly be a minimum, allowing the LSE's to procure more than this amount to count towards the target. Here again, Massachusetts does not need to re-learn a lesson that California learned. California originally decided that the customer domain allocation was a minimum and maximum. The utilities were required to procure the target amount while any MW beyond that amount did not count against the overall target. The Commission realized its error after one utility procured more than its entire BTM sub-target in one of its first solicitations. At its first opportunity to improve the storage target regulations, the California Public Utilities Commission modified the rules so that the customer domain target number was a minimum and allowed the utilities to procure up to twice the minimum as an upper limit. In fact, Southern California Edison has already procured more than twice as much BTM storage than what was originally required by the PUC (170 MW) years ahead of the required timeline.

i) Lessons Learned from California – BTM is cost competitive and readily available

In 2013 and 2014, the California Public Utilities Commission ordered Southern California Edison to procure between 1,900 and 2,500 MWs of local capacity resources, of which 50 MWs was required to

[2] "The Economics of Battery Energy Storage," Rocky Mountain Institute, October 2015
[3] "Utility of the Future," MIT Energy Initiative, December 2016

be energy storage. Edison subsequently conducted procurement processes and ultimately procured 263 MWs of energy storage, which the Commission approved in Decision 15-11-041 on November 24, 2015.

Edison discovered through these procurement efforts that energy storage could provide an unexpectedly wide range of resource benefits to both customers and the utility transmission and distribution grid at cost-competitive prices. Through this competitive (all-source) procurement, Edison procured more than five times its required amount of energy storage AND more BTM storage than their entire BTM target at the time (135 MW / 540 MWh of contracts between AMS and Stem).

The "lessons learned" from Edison's procurement include that utilities should encourage innovation, let the creativity of the marketplace provide storage solutions, and be prepared for unexpected amounts of competitively priced offerings. Energy storage is an extraordinarily flexible resource, capable of providing valuable service directly to host customers *as well as* to the distribution and transmission grid. This flexibility enables storage resources to provide multiple services, e.g. reliability and resilience for customers, and energy and capacity at the grid scale.

Edison's subsequent procurements demonstrate that energy storage can be deployed quickly and in areas with air quality constraints. In Edison's Preferred Resources Pilot program, Edison took the initiative and included energy storage within the scope of the solicitation based on Edison's knowledge that energy storage could provide cost competitive resources in an area with air quality constraints. Again, BTM storage was an unexpected winner in this procurement with SCE and AMS signing an additional set of 40 MW / 200 MWh in distributed storage contracts. Similarly, when needing to quickly bring on resources necessary to ensure reliability in response to the Aliso Canyon gas field curtailment, both Edison and San Diego Gas & Electric turned to energy storage for timely, cost competitive, and air quality compliant resources.

Implementation – Create mechanisms as quickly as is feasible

By leveraging the State of Charge report recommendations and program design processes already conducted in other states, the DOER need not take the years California took to launch energy storage deployment mechanisms. Rather, the target implementation structure should optimize for the fast-acting capabilities of behind-the-meter market firms and the longer timeline needs of certain LSEs and front-of-the-meter stakeholders. We thus suggest the phased policy rollout enumerated below.

Phase I: DOER Behind-the-Meter Incentive programs (2017)

The BTM storage industry enjoys considerably faster deployment capabilities than the FTM segment owing to specifics in sales cycle, business model, and technology. In tandem, the DOER has started to develop two BTM storage programs: The Next Generation Solar Incentive (NGSI) program with a storage adder and the MOR-Storage program. The DOER is empowered to move quickly in the design and implementation of these programs with funding sources already identified. We thus recommend that the DOER move forward with the rollout of both programs in 2017. These programs will create a

market driven structure for BTM energy storage - driving investment, innovation, and economies of scale for energy storage in Massachusetts. Such programs incentivize the fastest moving stakeholders, while providing ramping time for other stakeholders. Storage MW deployed through these programs should count towards the 2020 target.

The California Self Generation Incentive Program – ("SGIP"), focused on BTM storage, provides valuable lessons from its successes and failures. Discussion on how these lessons pertain to the new NGSI program has already been solicited through the comment process. We thus offer additional comments on SGIP lessons learned pertaining to the design of the MOR-Storage program. Specifically, we recommend the following design implementation elements:

ii) Planned stepdown of incentive level ($/kW) by either MW milestone or timeline to avoid shocks to industry of funding stop/ starts and to provide investment guidance.
iii) Incentive stepdown based on industry cost decline projections to reach market cost-competitiveness.
iv) Incentive level ($/kW) sufficient to bridge current market barriers, but low enough to require the system to create sufficient independent value to achieve market driven returns.
v) Equipment verification and quality guidance.
vi) Multiple use/ value stacking: ESS systems under this program should be allowed to stack revenues and participate in additional markets (i.e. DR, ancillary services).

Phase II: LSE Procurement by 2020

Beyond the BTM incentive programs recommended above, we suggest the following guidance for the full implementation of the procurement target by 2020.

We recommend division of the 750 MW target be tabulated for all Load Serving Entities in state, regardless of DOER jurisdiction. In keeping with the theme of simplicity and flexibility we suggest that specific allocation of the MW across use-cases defer to LSEs within certain guidelines. In order to oversee this process and ensure compliance, we then recommend that no later than 120 days after the effective date of the DOER decision, each LSE must file a comprehensive plan to meet that LSE's target.

The Plan must:

i) Set forth a feasible and cost-effective acquisition strategy through which the LSE will procure its share of the target by January 1, 2020.
ii) Provide that no less than 50% of all energy storage projects will be owned and operated by customers or third parties
iii) Provide that no less than 50% of all energy storage projects will be installed on customers' premises.
iv) Analyze transmission or distribution upgrades that could be deferred with energy storage and identify no fewer than three locations where storage will be evaluated in detail.
v) Include no fewer than three solicitations for storage as an alternative to transmission or distribution upgrades.

vi) Examine and update tariffs and practices necessary for energy storage to participate fully in the ISO-NE markets.
vii) Set up programs, building on existing funding if available, to install energy storage to improve the resilience of critical facilities.

Additionally, we recommend that the DOER set aside resources to provide technical and logistical support to LSE's in order to assist them in the development and scaling of their storage interconnection process in order to meet the procurement deadline.

Conclusion

In conclusion, AMS, Green Charge, and Stem thank the DOER for this opportunity to comment on the forthcoming energy storage target. By setting a target of 750 MW procurement by 2020, evenly distributed between customer and grid sited resources, Massachusetts will be well positioned to drive industry growth and reap ratepayer benefits. We thank the DOER for their forward-thinking leadership on this matter.

Signed,

/s/ Manal Yamont
Manal Yamont
Vice President, Policy
Advanced Microgrid Solutions

/s/ Daniel Vickery
Dan Vickery
Director, Market Development
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Energy Storage Mandate In MA

Breaking Down Silos from the Start Line

Energy storage should not operate in a silo. This storage mandate should dovetail seamlessly with existing state energy and environmental policies, including the utility energy efficiency and grid modernization programs, the RPS, and the GWSA targets. New York has established a zero energy credit program to incentivize all carbon free electricity generation, and we should learn from their process that cuts through all the programs, policies, and markets.

Fostering a Competitive Environment

A competitive environment must be established to ensure energy storage is implemented as cost effective as possible. The market power of monopoly and entrenched companies must be overcome with clear lines of market participation drawn at the outset. As evident in New York's recent energy policy development with the REV program it is evident that there are ways to address the creation of a fair and balanced participatory market for storage and distributed energy resources where utilities can invest in technologies where market participants cannot for certain specific reasons, but not participate in certain other instances.

In New York, the REV process[1] is considering allowing utilities to own distributed energy resources (DER) when:

1. Competitive procurement fails to offer technology options or the options more costly than utility ownership.
2. Energy storage and generation is located on utility property and is directly integrated into distribution service (helping to meet electricity distribution reliability goals).
3. In certain circumstances (including with low and moderate income customers) where there does not appear to be a developing market for DER. Where system benefits and/or substantial customer benefits can be achieved with DER projects, in areas that are not being served by markets, utilities will be able to propose programs to achieve them. This option would require a stakeholder process to ID beneficial programs.
4. Demonstration projects that include third party and utility partnerships.

Other issues, identified in NY, that likely will need to be addressed to build a solid competitive environment include: utility affiliate ownership that must go through a third party verification process; the need for a 'codes of conduct' for utility and affiliate behavior; 'market cap shares' could be determined to ensure market power is not abused by utilities and their affiliates.[2]

Data transparency

A challenge to overcome is transparency and data sharing on the locations on the distribution and transmission grids where storage is needed. We can learn from California's Locational Net Benefits Analysis (LNBA) as part of their Distribution Resource Planning (DRP) that has been successful at

[1] Source: New York State of New York Public Service Commission, Case 14-M-0101 - Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision. Order Adopting Regulatory Policy Framework and Implementation Plan. Issued and Effective: February 26, 2015. Pages 68-70.

[2] Id.

minimizing silos by taking and enterprise-wide look at the electric grid. Sharing data is the most crucial and difficult part of this process, and the Commonwealth has fallen behind other states' energy leadership despite recent efforts. Utilizing third parties to help lower costs requires transparency to the needs of the electric distribution system. Our process in MA must address this issue at the outset, and might take form in qualified companies gaining access to data like the way competitive electricity suppliers can access otherwise confidential customer usage data to customize products for consumers.

Further, by standardizing utility company approaches the market will have consistent signals across distribution company territories.

California's Distribution Resources Plan (DRP)[3]

* Identifies optimal locations for distributed energy resources (DERs)
* Establishes Section 769 that acknowledges the need for investment to integrate cost-effective DERs
* Requires unified methodology for determining circuit integration capacity and net benefits methodology
* Recognizes need to revise tariffs and incentives to promote DER in locations that provide the greatest net benefits to the grid
* Provides for discussion on safety benefits, barriers to deployment, and integration with existing Commission approved programs and coordination with the General Rate Case

To determine the hosting capacity available for DERs, each utility:

* Evaluated each circuit's DER hosting capacity by considering thermal ratings, protection system limits, and power quality standards to meet safety standards
* ICA analysis performed by line section, between 3 - 4 segments per circuit
* Displayed results via online maps

Incubate Energy Storage Companies

The Commonwealth should use this opportunity not just to install (battery) storage but to incubate technologies and processes to establish Massachusetts as an innovation center in the energy storage industry. Our investment in the Wind Technology Testing Center and the New Bedford Marine Commerce Terminal through the Clean Energy Center should be continued with this important technology.

A way to incubate local companies' storage innovations is to establish a carve out or market cap share for new storage technologies and pilot / demonstration projects at grid strategic state facilities / universities and industrial sites. This should be a priority to keep the Commonwealth on the cutting edge of developing new storage technologies and management processes to exploit as much value from technology in this budding global industry. With outside the box investments today in new storage approaches we can ensure Massachusetts will be a global leader in this field as we are establishing in solar and wind.

Leverage All Available Markets and Realize All Value

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[3] Source: Takayesu, Erik. Southern California Edison - Distribution Resources Plan. More Than Smart Webinar. August 4, 2015.

While FERC and ISO-NE, individually, are presently exploring how to incorporate storage into energy markets with ancillary services and other developing markets, the Commonwealth's storage policy should stand ready to capitalize on the new rules established. Further, this storage mandate should be a guiding force to those developing policy initiatives. While a storage mandate is not a new idea, California mandating 1.3 GW of storage by 2020, we can look at our process as an iterative process as we have done with solar. If the market is structured properly we will be able to meet and exceed 600 MW of storage and then require a new goal for the next iterations of storage technology that aims to come in at a lower cost and offer increased benefits to both consumers and the electric grid.

In California, a deep effort has been undertaken to identify all the value that can be realized from strategic storage use, and we can use their work here.
Southern California Edison's value identification methodology includes[4]:

* Objective is to identify optimal locations where DERs could provide a high benefit value
* Avoided sub-transmission, substation, and feeder-level CapEx and O&M related to forecasted load growth
* Avoided CapEx and O&M related to ensuring distribution voltage and power quality
* Avoided CapEx and O&M related to maintaining/enhancing distribution reliability and resiliency
* Avoided system and local-area transmission CapEx and O&M
* Avoided flexible RA and renewables integration expenditures
* Avoided societal costs and avoided public safety costs linked to the deployment of DERs

Market Cap Shares

600MW is a conservative goal based on State of Charge's 1,700+MW identified cost effective storage opportunity in the Commonwealth. So, 600MW of competitively procured storage **and** 200MW of demonstration project storage might likely be a short-term (by 2020) goal. Just as SRECs are a sub-category of RECs so could certain types of storage technologies or implementation methods be divided into bins with individuals caps for each.

The storage mandate should have a clear delineation between electric storage and other forms of storage including natural gas (if being considered) with priority for strategically placed electric storage aimed at reducing peak demand. An example of needed demonstration projects comes from Southern California Edison's approach[5]:

1. Demonstrate Integrated Capacity Analysis
2. Optimal Locational Benefit Analysis
3. Field Demonstration of DER Locational Benefits
4. Distribution Operations at High Penetrations of DERs
5. Demonstrate DER Dispatch to Meet Reliability Needs (a.k.a., microgrid)

[4] Id.
[5] Id.

Sparkplug Power
BRIDGING THE GAP

January 27, 2016

Judith Judson, Commissioner
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

RE: Sparkplug Power's Reply to Energy Storage Stakeholder Input Request Pursuant to An Act Relative to Energy Diversity, Chapter 188 of the Acts of 2016

Dear Commissioner Judson:

Sparkplug Power, a Massachusetts startup working out of Greentown Labs in Somerville, MA, has the first aggregated, distributed energy storage contract in New England with our Pilot Project with Holyoke Gas & Electric. We are delighted to be able to respond to this request for Stakeholder input regarding both the Chapter 188 of the Acts of 2016, Section 15, as well as the Department of Energy Resource's (DOER) December 27 mandate determination.[1]

Energy storage as an industry is in its infancy. Overall, Greentech Media estimates 260 MW of storage capacity were installed nationwide in 2016, a fraction of which was Behind–the–Meter (BTM) storage. In generation terms this equates to a medium sized gas turbine facility.

As such industry business models and rules have gone through only the early stages of development and the majority of that has been centered in California. As Massachusetts sets its target, Sparkplug Power recommends an emphasis on speed and discovery in the development of the regulatory framework for the Energy Storage Mandate.

The DOER's *State of Charge* report recommendation of a 600MW target by January

[1] Ch188 of the Acts of 2016, Section15 hereafter referenced as Section 15. The reference is available online at: https://malegislature.gov/Laws/SessionLaws/Acts/2016/Chapter188

1, 2020 is well sized and timed. Sparkplug Power supports this target. By focusing operational deployment prior to 2020 the process of real world discovery will be accelerated here in Massachusetts providing both a model for the rest of the country and learning for the firms participating in this market.

As we create a new market for Energy Storage and go through a process of discovery of successful business models; speed is more important than size in terms of the mandate. Speed draws entrants to the market as demonstrated by the volume of prior responses to the question of whether to establish a target or not. Energy Storage is well suited to such a process of discovery as it has the ability to quickly deploy systems and then to substantially scale those system models. Already we have seen rapid deployment contracts signed in California in response to the Aliso Canyon incident. As we deploy multiple competing systems at various scales we fulfill one of the functions of the mandate; that is to learn by doing all the aspects of the soft costs of real world deployment.

While Sparkplug Power is advocating disparate approaches and trials, it is important to remember the scale of the mandate as it relates to the other endeavors of the Electric Distribution Companies (EDCs). Undeniably, 2020 will arrive fast; nonetheless this mandate is well within the capacity of the Commonwealth's EDCs to meet in conjunction with the tens of companies participating in this stakeholder response.

What constitutes 'achievement' of the targets? Section 15(a) describes the setting of targets "to be achieved by" January 1, 2020". To Sparkplug Power achievement of the targets should correlate to Commercial Operation Date as a generally accepted practice in other areas of power generation. Nameplate rated capacity should be the governing metric in quantifying the assets. Imposing duration requirements (kWh/MWh) would unduly stifle new and innovative use cases due to the variance and complexity of ratings regarding duration.

Though we advocate sticking to an aggressive calendar, EDCs should be free to develop Energy Storage assets and contracts for Storage services without overly rigid planning. Avoiding early path dependency lock-in, developing Massachusetts based firms and technology, and promoting diverse approaches should be core goals of this early target.

Not all viable experiments will be a result of a least cost Request for Proposals auction. Additionally, EDCs should be incentivized to allow third party options to flourish in their service territories by allowing EDCs to count those deployments as

their success. Distributed Energy Resources (DERs) often suffer in regimes where the host EDC is effectively penalized for their presence.

Currently, centralized large-scale storage deployments have lowest costs per installed kilowatt or kilowatt-hour. Yet that is only half of the equation. Just as Energy Storage is often viewed as "too expensive" when cost is viewed in isolation of benefits, so to is that the case with BTM installations. However BTM installations offer great promise in stacking benefits and with fleet aggregation that are not easily quantifiable. The Rocky Mountain Institute has created an in-depth study of these benefits.[2] These advantages are not associated with centralized, transmission level assets.

As a member of the New England Clean Energy Council (NECEC) Navigate Northeast program, we support and endorse NECEC's comments on this matter with specific emphasis on NECEC's suggestions on the structure of a Avoiding early path dependency lock-in, developing Massachusetts based firms and technology, and promoting diverse approaches should be core goals of this early target.
BTM carve out.

A direct incentive to consumers of Energy Storage services can drive creative solutions leading to much greater discovery of how to capture the full stack of benefits. Solar has had the federal Investment Tax Credit and wind power the Production Tax Credit. Energy Storage has seen success in driving distributed deployment with the Self Generation Incentive Program (SGIP) in California. The *State of Charge* recommendation for a MOR-Storage or SGIP like program would replicate these successes.

Municipal Light Departments are generally beyond the scope of this regulation but should be afforded the ability to benefit under the EDC regulation. In many cases MLDs, like our partners Holyoke Gas & Electric and Reading Municipal Light Department and also Sterling Municipal Light Department, with their DOER and US DOE sponsored project, have been early innovators in energy storage deployment in Massachusetts.

Sparkplug Power thanks DOER for your efforts in creating this Energy Storage market structure and look forward to the further evolution of the energy storage market in Massachusetts. In conclusion we submit that a 600MW target with

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[2] RMI *"The Economics of Battery Energy Storage" available at* http://www.rmi.org/electricity_battery_value.

achievement construed as Commercial Operation by 2020 combined with a specific carve out for BTM systems is key to ensuring Massachusetts' role as both a market innovator and technology provider for the developing Energy Storage market nationwide.

Respectfully Submitted,

Sean M. Becker
President
Sparkplug Power, Inc.

Cc: Will Lauwers, DOER

Bloomenergy™

January 27, 2017

Commissioner Judith Judson
Department of Energy Resources
100 Cambridge Street
Boston, MA 02114

Via email: Storage.DOER@massmail.state.ma.us

Re: Request for stakeholder feedback regarding energy storage targets

Dear Commissionner Judson:

Bloom Energy Corporation ("Bloom Energy") hereby respectfully submits its comments in response the Department of Energy Resources' ("DOER") request for stakeholder feedback on appropriate target scale, structure, and mechanisms for the energy storage targets.

Bloom Energy is a provider of solid oxide fuel cell technology that produces reliable base load power using a highly resilient and environmentally superior electrochemical (non-combustion) process. Bloom has installed over 210 MW of projects for customers including AT&T, the Home Depot, Comcast, Walmart, and Ikea.

The advent of the Bloom Energy Server™ enables electric utilities and their customers to deploy a new form of clean, reliable, base load generation that can be targeted into specific locations on the electric or gas grids, irrespective of the presence of a thermal load. The result is a new option for energy infrastructure that combines increased predictability and electrical reliability with minimized environmental impacts.

Through a recent partnership with PowerSecure, a subsisidary of The Southern Company, Bloom Energy recently incorporated energy storage into the Bloom fuel cell platform. The result is an integrated package of high-

resiliency baseload distributed generation combined and flexible on board storage capable of adapting to changing conditions.

Bloom Energy believes it is critical that the DOER focus not only on large scale grid side storage but also include targets and corresponding policy support for smaller scale distributed energy storage, including behind the meter energy storage. As such, Bloom strongly supports the Northeast Clean Energy Council's comments calling for a 750 MW target by 2020 with a 50% subtarget for behind the meter systems.

The deployment of storage in behind the meter locations will contribute to avoided line losses, avoided transmission and distribution investments, and avoided operation and maintenance expenses. When charged directly by an onsite generator, behind the meter storage can avoid inefficiencies associated with the need to convert power from direct current (DC) to alternating current (AC) and then back to DC again. Importantly, storage in behind the meter applications can enable customer resiliency in ways that centralized grid side storage cannot, including the ability to island from the electric grid and work in concert with on-site generation during longer duration system outages.

Distributed energy storage also has the capability to be paired with DC generation, like fuel cells, to provide more efficient electric vehicle charging by avoiding an AC to DC conversion. Electric vehicles have the potential to make dramatic reductions in carbon emission and other forms of pollution from the transportation sector. Policymakers should encourage the development of a distributed, efficient, and non-combustion infrastructure that uses DC power – combined with distributed storage - to rapidly charge electric vehicles at places like shopping malls, retail stores, hotels, and rest stops.

The characteristics and location of power generation and storage resources have a great impact on the actual costs to ratepayers. DOER should therefore align its targets and its policies with ratepayer interests and public security interests by focusing on those projects that will best increase the efficiency of the overall electric system while also enabling customer resiliency.

We recommend that energy storage not be included as an additional eligible technology under the Alternative Portfolio Standard ("APS") unless the APS minimum obligations are significantly increased. Without increases in the APS obligations there is the potential for an oversupply of credits at a critical moment in the development of the MA APS market and a concomitant potential for under-support of energy storage.

Finally, in order to achieve intended objectives, it is important that energy storage targets and policies be constructed such that they do not incent the charging of storage via the electric grid without regard to the source of electricity. This could be achieved by limiting the charging of energy storage to non-combustion resources or by establishing a minimum heat rate standard.

Thank you for your time and consideration on this matter. Please do not hesitate to let us know if you have any questions or would benefit from further information.

Very truly yours,

/S/

Christina Fisher

Christina Fisher
Senior Manager, Policy
Bloom Energy Corporation
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Good for the Economy.
Good for the Environment.

E2 New England
28 Banks Street
Cambridge, MA 02138
www.e2.org

January 27, 2017

VIA E-MAIL
Storage.DOER@massmail.state.ma.us

To DOER Energy Storage Working Group:

On behalf of the New England Chapter of Environmental Entrepreneurs (E2), thank you for the opportunity to comment on the adoption of state targets for energy storage system targets. We reviewed the State of Charge Study published in 2016 by DOER and MassCEC and agree with the goal of setting an energy storage target to modernize the state's grid and drive continued growth of clean and cost effective renewable energy.

Renewable energy's success in Massachusetts has been a grass-roots effort supported by carefully managed incentives. Just as the RPS spurred a thriving renewable energy sector in the state, storage should be encouraged similarly.

In order to best achieve all cost-effective energy storage and the benefits it will bring, and to maximize the market signal for different types of storage technologies, DOER should establish mandatory procurement targets for each electric company requiring the procurement each year of specific minimum quantities (MW) of each of the following: distribution-level storage, merchant storage, and "behind the meter" storage sited with consumer end-uses.

In doing so, DOER's sub-target allocations should recognize that generally, behind the meter storage has the potential to provide the greatest range of system benefits, and the closer to the consumer storage is sited, the more such benefits are likely to accrue to the grid and to Massachusetts businesses and families.

Specifically we urge you to:

1. **Set a mandatory storage target of 750 MW installed or contracted by 2020.**
   - *This ambitious target more closely approaches the 1,766 MW that the State of Charge Study stated, "would maximize Massachusetts ratepayer benefits" by 2020.*

2. **Adopt a minimum carve-out of 50% for behind-the-meter (BTM) energy storage systems**
   - *Energy storage delivers a different set of benefits at different scales of deployment. The State of Charge Study undervalues the benefits of behind-the-meter systems by not sufficiently valuing third-party (non-utility) dispatch and aggregation; and BTM systems' ability to provide distribution services and participate in wholesale markets.*

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- *Requiring a 50% target for BTM installation ensures that the program will not become dominated by a few MW-scale projects and ensures the participation of locally owned businesses, schools, non-profits and homeowners.*

3. **Avoid setting a minimum energy storage system size that would prevent residential and small commercial customers from realizing the benefits of behind-the-meter energy storage.**
   - *There is much innovation in energy storage at the residential and small commercial scale based on the ability to aggregate and deploy sites as Distributed Energy Resources (DERs). The DOER should support this important and growing segment of the energy storage market.*

About E2
Environmental Entrepreneurs (E2) is a national, nonpartisan group of business leaders, investors, and professionals from every sector of the economy who advocate for smart policies that are good for the economy and good for the environment. Our members have founded or funded more than 2,500 companies, created more than 600,000 jobs, and manage more than $100 billion in venture and private equity capital.

Thank you for consideration of the E2 business perspective on these issues. Please contact Berl Hartman at 617 497-0393 or at berl@berlhartman.com if you have any questions.

Sincerely,

Berl Hartman
Director, E2 New England

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AMBER KINETICS

January 27, 2017

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114
Via e-mail to Storage.DOER@massmail.state.ma.us

Re: Feedback requested on appropriate energy storage target scale, structure, and mechanisms

Dear Commissioner Judson,

Amber Kinetics applauds the Department's decision to set energy storage procurement targets to be achieved by Jan. 1, 2020, for all the reasons cited in the recent *State of Charge* report, and appreciates this opportunity to provide the feedback requested.

Amber Kinetics is a California based company (with founder roots from MIT) that has developed a utility-scale flywheel capable of providing cost-effective, high duration (4 hours or more), long-life, low risk energy storage to supply both capacity and ancillary services to meet the system needs inherent in a growing supply of renewable energy. Amber Kinetics' technology can store renewable energy for optimal dispatch, replace or defer fossil fuel peaking generation or transmission and distribution upgrades, and increase the overall reliability of the grid. This mechanical form of energy storage also has a number of distinct advantages relative to other storage technologies, including unlimited cycling, no degradation, no fire risk, and no hazardous material storage or disposal needs. Our company has units in operation and contracts for multi-megawatt utility-scale plants in California, Hawaii, and the Philippines. We are very interested in exploring opportunities to deploy our technology in Massachusetts.

We offer the following brief comments in the spirit of adding our voice to what you have been hearing from others and in hopes of continuing to contribute to the dialogue as the details for target goals and implementation get worked out. We encourage DOER to:

AMBER KINETICS

- Set aggressive goals for the targets, both to speed achievement of the benefits laid out in the State of Charge report as well as to help stimulate market development for both new and existing energy storage technologies.

- Set targets for both in front of and behind the meter storage, to ensure achievement of the full gamut of potential benefits from more widespread deployment of energy storage.

- Identify the purposes of the storage, including utility-scale capacity and energy, ancillary services, grid-stability, renewable energy firming, and T&D deferral.

- Ensure that definitions of "cost-effective deployment" consider the full life cycle costs of manufacturing, deploying, operating, and disposing of energy storage technologies.

- Create mechanisms for target implementation that help ensure a diversity of technologies deployed to meet those targets, so as minimize the risks associated with ongoing development of these technologies.

- In the near term, specifically include policy and financial mechanisms that encourage piloting and demonstration of emerging energy storage technologies.

Sincerely,

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AMBRI

January 11, 2017

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge St, Suite 1020
Boston, MA 02114

Subject: Ambri comments on MA storage procurement

Dear Commissioner Judson,

Ambri thanks and applauds the Department of Energy Resources (DOER) for your decision that it is prudent for the Commonwealth to set targets for electric companies to procure viable and cost-effective energy storage systems. We appreciate the Commonwealth's leadership in highlighting the potential for energy storage to: 1) help the grid function better, 2) enable integration of substantial intermittent renewable resources and 3) grow a new valuable global industry.

With this letter Ambri provides its comments to DOER's request for stakeholder input regarding the appropriate target scale and mechanisms for these targets. These are similar comments to those included in our letter dated December 15, 2016 to the DOER regarding energy storage target adoption.

Ambri suggests a mandated target for energy storage of 1.5 GWh by 2022, representing one percent of the Commonwealth's average daily electricity consumption.

Massachusetts uses 54.5 TWh of electricity annually. In considering the size of a target, Ambri recommends applying the "Goldilocks principle" – "not too hot and not too cold." The DOER should assure the target is large enough that substantial, relevant experience is gained by all, but not so large that it becomes unworkable and a substitute for the fully-functioning market. Therefore the target must be high enough to spur regulatory and market solutions that will emerge to enable storage to realize its fullest potential on an agnostic level playing field.

The DOER and the Commonwealth of Massachusetts should encourage electric utilities and others to include demonstrations of emerging energy storage technologies as a part of their procurement targets.

There are a number of emerging battery and other storage technologies – such as Ambri's Liquid Metal Battery - that promise to have distinguished ratepayer benefits. For example, Ambri is commercializing a safe, low cost, long lifespan and flexible storage solution that can be used in multiple grid applications. Early opportunities for field deployments of emerging storage technologies with established parties are critical to gaining experience necessary for the widespread adoption of these technologies in the future. Ambri asks DOER to encourage utilities to give extra weighting for a portion of their energy storage projects to include deployments of new technologies. These new technologies inherently have less of an experience track record and therefore may be seen as technically "riskier." DOER's encouragement will help utilities and the Commonwealth realize the benefits from new technologies as well as hiring in Massachusetts and spurring economic growth.

AMBRI

I look forward to your continued efforts on this opportunity for the Commonwealth.

Best regards,

Phil Giudice
Chief Executive Officer
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617-714-5723 ext 450

Via email to Storage.DOER@massmail.state.ma.us

January 27, 2017

Will Lauwers
Director, Emerging Technologies
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

BORREGO SOLAR COMMENTS TO DOER ON IMPLEMENTATION OF ENERGY STORAGE TARGETS

Dear Mr. Lauwers:

Thank you again for the opportunity to provide comments on DOER's plan to implement targets for energy storage in Massachusetts. We were very glad to see DOER's late 2016 decision to move forward with energy storage targets. Energy storage has a valuable role to play in the evolution and modernization of our electricity system, and our early experience in this market tells us that we are at a critical time for public support and investment. With energy storage costs falling and performance improving, now is the time when strong public policy support can carry energy storage across the threshold from potential to commercialized and integrated into a cleaner, cheaper, more resilient electricity system.

As a member of the Northeast Clean Energy Council, we support NECEC's comments, submitted separately.

Energy storage targets should support a range of applications, and should not be simply aspirational

Borrego Solar provided comments to DOER on 12/16/16, on the question of whether the Commonwealth should establish energy storage targets. Those comments remain relevant to the questions at hand here, and we ask that DOER refer back to those short comments in its consideration not just of *whether* to set energy storage targets, but *how* to do so.

As we wrote in December, policies to promote energy storage in Massachusetts are needed because there are many applications for energy storage, as identified in *State of Charge*, that have a benefit:cost ratio greater than 1.0, but because today's electricity marketplace lacks adequate structures to allow market participants to capture the benefits of energy storage, market actors are not on their own adding energy storage to the Commonwealth's electricity infrastructure. Without reiterating our December comments at length, we believe that point has two main implications that are relevant to the question of *how* to set energy storage targets.

The first implication is that energy storage targets, especially at this early stage of the energy storage market in Massachusetts, should foster a range of use-cases, applications, and ownership and investment models; we should pursue the range of applications with a positive benefit:cost ratio, putting ourselves in the best position in 2020 to make further choices about how to use energy storage effectively and efficiently in our energy system.

The second implication is that to fail to set or achieve energy storage targets would mean a less-efficient, more costly electricity system, and a missed opportunity to de-carbonize our energy system, invest in Massachusetts, and create jobs. For that reason, energy storage targets should not be purely aspirational; we should implement specific policies that will result in achieving the energy storage targets, on time, and cost-effectively.

Accordingly, we propose a set of policies that would do two things. One, it would establish and achieve near-term targets for energy storage deployment by 2020, with aspirational targets for 2025 that will require further policy-making to achieve. And two, it would lead to a range of cost-effective energy storage applications, use-cases, and ownership models, such that many different cost-effective applications are supported, giving market participants and policy-makers useful experience in this first phase of energy storage deployment and integration.

DOER should establish an energy storage target of 600 MW by 2020, across three 200 MW buckets

State of Charge concludes that the Commonwealth's electricity system could make cost-effective use of nearly 2 GW of energy storage capability in the near term. Over time, that figure will likely increase, with deeper penetration of intermittent renewables and falling energy storage costs. We suggest a near-term, 2020 target of 600 MW, and a 2025 target of 1600 MW, aligning with *State of Charge*.

A 600 MW target could be achieved in three 200 MW buckets: energy storage paired with solar in the next generation incentive program, utility-owned energy storage, and stand-alone energy storage developed in the competitive market, funded through a series of grant RFPs that follow the upcoming ACES RFP.

This structure would provide many benefits:

1) It would accelerate the adoption of cost-effective energy storage in Massachusetts;
2) It would foster and support the early-stage growth of another local clean energy industry sector, attracting investment and creating jobs;
3) It would give a range of market participants and stakeholders useful experience with energy storage in the Commonwealth, helping to lower costs, learn about different applications, and chart a course for further energy storage deployment and integration; and
4) It would explore, demonstrate, and validate the range of applications identified in *State of Charge*, and teach policy-makers and other market participants about the barriers to adoption among different positive benefit:cost use-cases.

Critically, this proposal includes the policy mechanisms that are needed in order to make the energy storage targets not merely aspirational, but real. Each of the proposed 200 MW buckets has the necessary embedded mechanisms for funding and enforcement that are critical for success.

First, energy storage paired with solar is funded through the Next Generation Solar Incentive program. If the energy storage adder is properly designed, it will lead to deployment of cost-effective energy storage in that program. In previous comments on the storage component of the Next Generation Solar Incentive program, we have advocated that the energy storage adder should have a declining block structure within the Next Generation Solar Incentive program that steps down independent of step-downs in the base incentive rate. Setting that structure as four 50 MW steps, with an appropriately priced adder, would lead to 200 MW of energy storage through that program by 2020.

Second, the 200 MW bucket of utility-owned energy storage will give the regulated utilities the impetus they need to procure energy storage where it is cost-effective and useful in their distribution systems, and DPU review and approval will help ensure prudent investment. Many of the objectives for energy storage identified in *State of Charge* require significant engagement from the utilities, who are best-positioned to make good decisions about where the deployment of energy storage can be most operationally and economically beneficial to our electricity system. While it is important and valuable to leverage open-market forces to foster competition and drive down turnkey system costs, reserving some percentage of the market for utility-led development and ownership is a useful tool at this nascent stage of market development. This bucket would be the primary avenue for energy storage applications that focus on renewables integration and power quality, distribution system investment deferral, and local peak demand relief.

Third, relying solely on utility-owned and governed applications and on energy storage paired with solar would leave out many interested market participants, and would preclude many of the valuable and cost-effective applications identified in *State of Charge*. For example, customer-sited energy storage that is not paired with solar, or stand-alone energy storage in MLP service territories, are use-cases that often have positive benefit:cost ratios, but that are not viable under existing market structures. In this first phase of the Commonwealth's experience with and support for energy storage, it is important to include a broader and more open policy component, designed to encourage the development of cost-effective energy storage project types that don't fit into one of the first two buckets above. We suggest a series of competitive grant RFPs administered by DOER following on the ACES RFP. Possible funding mechanisms for this third bucket may require legislation if funds do not or cannot come from ACP funds. We would welcome the opportunity to discuss policy options for this purpose with DOER.

DOER should also establish an energy storage market structure task force to make recommendations by late 2018 that will help chart a path beyond 2020

For the near term, we propose a target of 600 MW, spread across three 200 MW buckets, deployed by the end of 2020. But the end of 2020, of course, is not far away. Taking into account the time it will take to implement policies, and for the market to get moving, we will have only begun making progress towards a 600 MW target before it will be time to start considering what comes after that, and how we build on this first phase towards a longer-term, sustainable vision for how energy storage is integrated into our electricity system.

Critically, that longer-term vision must include an initiative to address the market failures identified in *State of Charge*. Again, *State of Charge* is right to frame a simple problem: we aren't getting energy storage deployed in the electricity system, despite the fact that in many cases the benefits are greater than the costs, because we don't have market structures and rules that properly reflect many of the economic realities of energy storage.

In parallel with these near-term energy storage targets, we should work on that market failure. Accordingly, in addition to our 600 MW by 2020 recommendation above, we also urge DOER to form an energy storage market structure task force. The mission of this task force would be to recommend changes to rates, ISO market structures, interconnection policies, and other market rules, so that the benefits and costs of energy storage are better reflected in the open market. This task force would complete its work by the end of 2018, giving DOER and other policy-makers two years to implement its conclusions, along with early lessons-learned directly from the 2020 energy storage target programs, towards a next-phase energy storage program that builds on momentum from this first phase, towards a lower-cost, home-grown, maximally effective energy storage market and set of policies.

Thank you again for the opportunity to provide these comments. We look forward to continuing to collaborate with DOER and other policy makers on the ongoing development of both the energy storage and solar markets in Massachusetts.

Sincerely,

Dan Berwick
General Manager, Energy Storage Division
Borrego Solar Systems, Inc.

Ilan Gutherz
Director of Policy and Business Development
Borrego Solar Systems, Inc.

VIONX ENERGY
Jonathan J. Milley
Director of Business Development

27 January 2017

Judith Judson, Commissioner
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

RE: Reply to Energy Storage Stakeholder Target Input Request of 27 December 2016 and Pursuant to *An Act Relative to Energy Diversity, Chapter 188 of the Acts of 2016 (the "Act")*

Dear Commissioner Judson,

As a Massachusetts based company, Vionx Energy Inc (Vionx) recognizes and appreciates the Department of Energy Resources' (DOER) leadership in promoting the benefits of energy storage for the Commonwealth. Vionx is pleased to have the opportunity to provide input into this ground-breaking process via comment on the targets to be established for energy storage within Massachusetts.

Vionx is the leading vanadium redox flow battery (VRB) manufacturer with its headquarters and engineering facility located in Woburn. Vionx provides utility scale (>1MW) long-duration (>4 hours) VRB systems designed for large-scale application in conjunction with intermittent generation resources, for transmission and distribution system congestion relief, and for long-duration energy supply and load shifting.

Vionx believes that DOER should establish an initial energy storage procurement target of 600 MW consistent with the recommendations made in the *State of Charge* report commissioned by DOER. The breadth and depth of value that energy storage can offer Massachusetts requires a scale of application in order to conclusively measure the benefits. Further, and consistent with the methodology reflected in the *State of Charge* report, the application of those targets should be made across the spectrum of the electric energy system on the basis of:

- Maximizing the capital utilization rate of existing, transmission and distribution grid resources and non-emitting generation resources, as well as the future large scale renewable energy assets envisioned for future procurement by the Act, via bulk load-shifting, congestion relief, peak price reduction, etc.
- Procuring various types of storage in a, "one size does not fit all" approach with regard to technology and capital cost per kWh such that the procurement can deliver on needs identified and benefits envisioned,
- Life of asset based cash flow analysis such that the benefits of specific project procurement is done over a length of time consistent with the benefits rendered and with the life of the concomitant procurement of the additional non-emitting, intermittent generation resources envisioned by the Act, and

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- Flexibility in the selection and analytic application of the storage technologies and their installation location such that the benefits of multiple grid applications can be considered over the life of the asset.

An example of a project procured along the points above might be a 50 MW – 8-hour duration storage system located in electrical proximity to a congested node from which it could provide bulk shifting of off-peak wind energy "downstream" of the congestion, be dispatched as a peaking generation plant, and/or be used for shorter-duration purposes providing ancillary services. The key attributes are size and duration and an analysis period over the same length of time as the alternative generation or transmission solution would be considered.

Additionally, the Bay State is home to several advanced technology energy companies and it would be useful to recognize the added economic growth rendered in-state via procurement from these companies. Massachusetts is becoming a hub of high-tech energy sector companies, but that is based in part on the continued commercial growth of native technology companies.

Vionx looks forward to working with DOER to identify opportunities for expanded use of energy storage for the benefit of rate payers in Massachusetts and appreciates your consideration of these observations.

Respectfully,

Jonathan J. Milley
Director of Business Development

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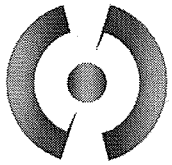

Helix Power

Comments to:

State of Charge

Massachusetts Energy Storage Initiative Study

Matthew Lazarewicz, President
Helix Power Corporation
28 Dane St. Somerville, MA 02143
Andover, MA 01810

January 24, 2017

Background

Helix Power Corporation is very pleased to comment on the recommendations for advancing energy storage technology presented in the Massachusetts Energy Storage Initiative *State of Charge* report. We are delighted to see the benefits of storage being recognized and considered for incorporation into the Commonwealth's infrastructure and technology leadership position.

Helix Power is an energy storage company based in the Commonwealth developing advanced flywheels for high value short duration storage markets (fewer than 5 minutes). It was fortunate to receive funding from the United States Department of Energy administered by Sandia National Laboratories to study the potential short duration energy storage and found large potential storage markets.

Helix Power encourages the Massachusetts Energy Storage Initiative to include short duration storage as it is not covered in depth in the *State of Charge* report. Specifically, the *State of Charge* report focuses on longer duration energy storage opportunities from "15 minutes to over 10 hours" (*State of Charge*, page iv).

Short duration storage, properly applied, has the potential to offer substantial savings in energy use, peak demand, and greenhouse gas emission reductions because such storage assets can be used tens or hundreds of times per day. As such, short duration energy storage can offer excellent asset utilization rates and high energy throughput. For example, preliminary analysis indicates 25-30MW of advanced high power flywheels potentially deployed wayside with the MBTA could reduce MBTA electricity demand by 30% and substantially achieve the Commonwealth's greenhouse gas emission reduction goals from energy storage. In this comment, we are offering suggestions on how short duration energy storage can be deployed and evaluated.

Measuring Energy Throughput In Short Duration Applications

Short duration applications require measurement of (1) effective energy stored in megawatt hours (MWh), (2) power output in megawatts (MW), and (3) cycling requirements (uses per hour). The multiplication of these three factors together determines the energy throughput and asset utilization of the device. In other words, the appropriate question in short duration applications is how much energy in megawatt hours (MWh) will productively flow through the device in a month, a year or a decade? With this information, benefit/cost analysis can be conducted and devices can be a compared on an apples-to-apples basis. Energy storage devices vary significantly in each of the above categories.

Cost effective short duration applications tend to require moderate stored energy, high power capability and high cycle life. For example, regenerative braking with MBTA trains may require 10kWh per stop, up to 3MW per stop, and hundreds of cycles per day. An evaluation of technologies for this application needs to include all three requirements. Summary information including only one or two factors is unlikely to produce accurate comparisons across technologies and applications.

MBTA Metro Train Greenhouse Gas (GHG) Emission Reduction Potential

Helix Power is developing technology with a power/energy ratio 10x greater than technologies reviewed in the *State of Charge* report (technically speaking 40C). As mentioned above, a target short duration energy storage application is productively recycling energy from metro train braking systems. In short, this involves capturing energy from regenerative braking systems and recycling it by delivering power back to

the train when it is accelerating to the next station. These types of applications are very important as metro train systems are often the single largest electricity consumer in metro areas and contribute significantly to peak demand. Our analysis shows that saving up to 30% of the MBTA's metro train electricity use is possible and that such savings would likely reduce 350,000 metric tons of GHG emissions in 10 years. We note that this potential for GHG emissions reduction matches the target 10 year GHG emissions savings goal in the *State of Charge* report (*State of Charge*, page xvii) without contribution from any other storage project. These high levels of GHG emission reductions are due directly to high energy throughput in the metro train applications due to both the number of trains and the number of train stops in any given day.

Summary

There are significant energy storage applications with durations of fewer than 5 minutes. We encourage the Massachusetts Energy Storage Initiative to include these applications in its future work. We believe that short duration energy storage due to high asset utilization and energy throughput rates can provide substantial benefits to the Commonwealth in reduced energy use, reduced peak demand and reduced GHG emissions. We believe the short duration market of regenerative braking with metro trains can be an important element of an energy storage plan for the Commonwealth.

PowerOptions

Dear Commissioner Judson:

PowerOptions appreciates the opportunity to provide comments to the Massachusetts Department of Energy Resources ("DOER") on the appropriate target scale, structure, and mechanisms for the energy storage systems targets. PowerOptions is a non-profit energy buying consortium providing competitively procured, pre-negotiated optimal pricing for electricity, natural gas, and solar energy to non-profits and public entities under best-in-industry contract terms and conditions. PowerOptions has close to 500 members in Massachusetts and several members in Connecticut and Rhode Island. Our members include hospitals and healthcare systems, colleges and universities, community and human service agencies, K-12 public and private schools, museums, as well as municipalities and housing authorities, with approximately 200 MWs of peak load and about one billion kWhs of energy. Many of our members have expressed interest in energy storage and PowerOptions believes that a well-structured target can facilitate widespread deployment in the state. PowerOptions will leave comments on the scale of the storage targets to developers, but would like to address two important policy considerations that will impact the effectiveness of targets: a behind-the-meter ("BTM") requirement, and a public project carve-out.

Efficient Market Development Requires Substantial BTM Deployment

PowerOptions recommends that the DOER require a percentage of the target be reserved for BTM projects. Without a BTM requirement, economies of scale would make it likely that large, utility-owned projects would dominate the vast majority of deployments. A larger quantity of smaller, BTM projects would facilitate a "learning by doing" that would help to drive down costs as seen in the solar industry. This would also facilitate greater competition, furthering the incentive to improve efficiencies where possible. Another benefit to robust BTM deployment is that it carries the potential to alleviate grid concerns associated with densely concentrated solar projects. Utilities have indicated that solar can strain the distribution system if not deployed efficiently, and that energy storage has the potential to alleviate these concerns.[1] If customers site their energy storage with BTM solar (as would likely happen), some of the impacts of solar deployment would be eliminated as customers export less energy to the grid. There is also the added benefit of customers with BTM energy storage being able to provide services to the grid, especially if a number of systems are aggregated by third parties.

[1] See, for example, D.P.U. 15-122, Exhibit EVERSOURCE-GMP: "There are certain areas where the growth in applications for these large facilities is so great that a large solution is required to ensure continued power quality. As a result, Eversource is proposing to deploy energy storage aimed at voltage smoothing to address PV intermittency."

For the reasons listed above, it is prudent for the DOER to require that a share of the energy storage target be met by BTM projects.

Public Entities Should Lead by Example

PowerOptions recommends that the DOER create a carve-out for public projects. Governor Baker has made it clear that reducing greenhouse gas emissions from the public sector is important to meeting the Commonwealth's emissions target, and that the public sector should lead by example.[2] By reserving a portion of the target for public projects, DOER would advance Governor Baker's goals and indicate that the state will be an active participant in promoting the development the energy storage industry. Further, a public project target will provide greater incentive for these customers to invest in energy storage as more developers will be vying for these projects. Without such a target, public entities may be hesitant to invest in storage using their tight budgets, and developers may shy away for that cause. Thus, it is in the best interests of both the state and the industry to set a target for public entities to incent development and to lead by example.

Policy Mechanisms

PowerOptions understands that the energy storage target is but one of a suite of policies that will be deployed to encourage storage development. PowerOptions does not have specific recommendations for which policies will be most effective in meeting the storage targets, but does advocate that market-based solutions are preferable to regulatorily-defined solutions. For instance, the *State of Charge* report[3] recommends that ISO-NE remove some of the barriers for energy storage to participate in the full range of available markets. Other recommendations, such as allowing storage to participate in future procurements, ensure that the deployed storage is as cost-effective as possible.

Conclusion

The DOER is taking an important step to create a Massachusetts-based, self-sustaining energy storage industry by setting deployment targets. To ensure that efficiencies are encouraged and that the grid impacts of solar are alleviated, a behind-the-meter requirement is imperative. To encourage public entities to lead by example and to achieve the state's greenhouse gas emissions goals, a public project requirement is prudent. PowerOptions

[2] See Executive Order No. 569, Section 1.b.: "expand upon existing strategies for the Commonwealth to lead by example in making new, additional reductions in greenhouse gas emissions from Government operations"
[3] http://www.mass.gov/eea/docs/doer/state-of-charge-report.pdf

PowerOptions

appreciates the opportunity to comment, and looks forward to seeing the DOER's conclusions on this issue.

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From: Travis O'Guin <travis@axiomexergy.com>
Sent: Monday, January 16, 2017 11:41 AM
To: DOER, Storage (ENE)
Subject: Axiom Exergy additional stakeholder input

Follow Up Flag: Follow up
Flag Status: Flagged

To the MA DOER,

Axiom applauds the DOER's decision to set targets for energy storage systems for the state of Massachusetts. In considering policies to encourage cost-effective deployment of these systems, Axiom encourages the DOER to consider the importance of technological diversity in structuring its targets. The policies should be structured to encourage a wide variety of storage technologies to participate in order to most effectively leverage the unique qualities and attributes of each.

Axiom recommends the DOER create a specific carve-out or a separate program for emerging technologies; companies and products that are new or just coming to market. These technologies often have great potential for cost-effectiveness, but face unique challenges not shared by more established companies. These challenges can make it difficult to apply to a program in the same way more mature companies do. Hence, a carve-out and streamlined application process can go a long way to encourage a strong response from emerging companies that can offer ground-breaking technologies.

Axiom also recommends the DOER consider a dedicated track/category for thermal energy storage. Thermal energy storage (TES) can provide very cost-effective behind-the-meter load reduction and demand response, but is often overshadowed by purely electric energy storage technologies. Thermal energy storage is efficient, low-cost, and long duration- excellent for aggregated demand response to alleviate congestion on the distribution grid. But applying a purely electrical energy storage framework to TES is problematic and ineffective. The two technologies operate uniquely and are measured differently. Metrics such as round trip efficiency are measured and rated completely differently for each technology category. Hence, a separate track for TES will allow regulators and utilities to focus in on a framework that accurately captures the value of TES and will encourage a robust response of cost-effective resources.
Aggregation is also an important factor in structuring targets. By allowing companies to aggregate multiple distributed resources together, participants can offer greater flexibility in their offerings and provide even more value to the grid.
The DOER should note that incentive-based mechanisms have proven to be very effective at eliciting a strong response from the storage industry. We recommend a program similar to the Self-Generation Incentive Program in California, which has been very successful. California has instituted a RFO process for its storage targets. A bidding process makes sense for very mature industries where future costs are well known. But for a more nascent industry, like energy storage, a bidding structure relies too heavily on offeror's modeling future costs in an industry that is still evolving rapidly. This can lead to distorted bids. A prescriptive incentive structure provides a concrete value that participants can incorporate more accurately into their project and financial modeling and does not rely heavily on assumptions of future growth or changes in cost.

Lastly, the scale of the targets should reflect at least the mid-term needs of the distribution and transmission grids, if not the long-term requirements. California instituted targets roughly equivalent to 3% of its current peak load and the response has been substantial. Axiom recommends targeting a scale of at least 5% of current peak load or higher; approx. 660+ MW.

Thank you and best regards,
Travis

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Travis O'Guin
Director of Business Development
510.683.5200 x1006
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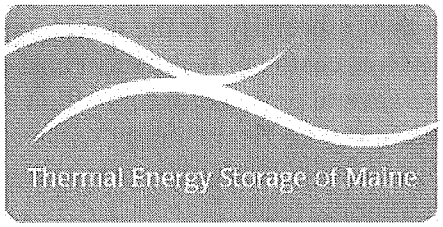

Will Lauwers
Director, Emerging Technology Director
Department of Energy Resources
100 Cambridge St., Suite 1020
Boston, MA 02114

January 27, 2017

TESM Comments on Energy Storage Target Issue

Dear Mr. Lauwers:

Thermal Energy Storage of Maine (TESM) is pleased to submit these Comments on the questions identified in the Department's December 27, 2016 Notice seeking stakeholder input regarding "the appropriate target scale, structure, and mechanisms for the energy storage systems targets." TESM serves as an independent developer in the New England area for Ice Energy of Santa Barbara California and is authorized to represent that Ice Energy concurs in these Comments.

TESM submitted Comments on December 16, 2016 on the issue of whether DOER ought to establish a storage target and is pleased that the Department has seen fit to take this important step. As explained in detail in Attachment A to our December 16 filing (which is again attached hereto), Ice Energy makes and markets the Ice Bear thermal energy storage unit which shifts air conditioning peak loads to the off-peak period. Ice Energy is eager to participate in the Commonwealth's storage market.

As to the specific topics on which the Department seeks comment, TESM offers the following:

Target Scale. Although the Department's *State of Charge* Report found that Massachusetts customers would see about a 2.0 benefit/cost ratio from the deployment of 1,766 MW of storage over time, it identified a nearer term, but still quite advantageous, goal of 600 MW that it thought could be acquired by 2025. TESM suggests that the DOER begin by adopting this as the target for initial storage integration, apportioning it among its jurisdictional utilities, and standing ready to adjust the target as results come in.

Structure. The deployment of Ice Energy's Ice Bears in a utility service territory requires the recruitment and qualification of numerous commercial Host customers willing to allow the installation of Ice Bears on their property and the integration of the Ice Bear's cooling system with their existing system. With the introduction of Ice Energy's new Ice Bear 20 residential model (an all-in-one unit providing 24-hour AC but with about four hours of dispatchable storage within the unit), Ice Energy has begun to enter the residential market.

Ice Energy's experience is that, especially for the initial entry into a service territory, offering Ice Bears at no cost to the Host customer is the most cost-effective approach to ensure widespread deployment. There are several reasons for this. First and foremost, in Ice Energy's fourteen years of experience in deploying Ice Bears, rarely will a commercial or residential utility tariff yield any dollar savings to a retail customer proposing to offer the utility an Ice-Bear-enabled dispatchable air conditioning load.

In fact, the primary benefit a Host customer sees typically relates to equipment considerations, rather than any significant anticipated dollar savings: the commercial Host customer's incumbent AC equipment will now have a reliable back-up, taking the incumbent system offline for many of the high-temperature hours of the day and, hence, extending service life. Also, in many cases Ice Energy, as part of its deployment program, will provide the commercial Host customer with a brand new, high-efficiency, packaged AC unit to replace an old, inefficient unit.

Likewise, in the case of the residential market, a no-cost approach gives the residential customer the choice of buying a conventional AC unit, or installing a free Ice Bear 20. Over time, one would give consideration to scaling back perhaps to 50/50, but only after the units have achieved widespread market acceptance in the Commonwealth.

Imposing a rebate approach in these cases, on the other hand, with the Host customer having to contribute cash, greatly increases sales resistance as well as transaction costs. Moreover, Ice Energy has found that it can bid very competitively with alternative storage or capacity sources with a no-cost-to-the-Host approach.

In this transaction structure, the unit installed at the Host's location (under a long-term License executed by the Host) is owned and maintained (again at no cost to the Host customer) either by the utility contracting for the deployment of the Ice Bears, or else by a financing party arranged by Ice Energy. In the latter case, the local utility leases the Ice Bears from the financing party. Ice Energy arranges with local contractors to install and then maintain the units in either case.

So long as the Department develops a storage program that allows for (a) Ice Bear deployment at no cost to the Host customer, and (b) ownership by the utility or a financing entity leasing to the utility, TESM is confident that Ice Energy will be able to provide substantial amounts of valuable thermal storage capacity to customers in the Commonwealth on a competitive basis.

Acquisition. TESM and Ice Energy assume that DOER will require its jurisdictional utilities to obtain new storage resources through a competitive bid process. Ice Energy has participated in competition with other storage and capacity resources and is confident that it can provide Massachusetts utilities with a competitive thermal storage alternative to electro-chemical batteries and other storage options.

TESM appreciates the opportunity to submit these Comments and plans to continue participating in any follow-on stakeholder activities in the storage arena that DOER might conduct.

Respectfully submitted,

Kimball L. Kenway. Vice President
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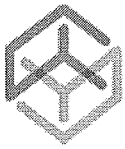

ICE ENERGY

ICE ENERGY THERMAL ENERGY STORAGE SYSTEMS SHIFTING ON-PEAK AC DEMAND TO OFF PEAK PERIODS

For the past thirteen years, Ice Energy, Inc. of Santa Barbara, California has been deploying its Ice Bear thermal energy storage units to shift a utility's on-peak air conditioning load from peak to off-peak periods. The Ice Bear is a fully integrated, smart grid-ready intelligent distributed energy storage solution for peak demand management. Our proven, smart grid platform combines Ice Bear distributed mature energy storage technology with an advanced software infrastructure and intelligent two-way control to provide utilities with a fully controllable, centrally operated, distributed energy resource.

The Ice Bear works in concert with existing direct-expansion ("DX") 5 to 20-ton package air-conditioning units typically found in most small to mid-size commercial buildings. The Ice Bear's efficient compressor operates at night (using off-peak energy) to freeze 450 gallons of tap water into a solid block of ice. During the peak hours of the following day, the utility remotely dispatches the compressor in the Host's incumbent AC units off-line and the refrigerant in the Host's system is automatically redirected to, and cooled by, the Ice Bear for at least six hours. The result of this process is to shift six hours of on-peak AC load to the utility's off-peak hours.[1]

When aggregated and deployed at scale, a typical utility deployment will shift the operation of thousands of commercial AC condensing units from on-peak periods to off-peak periods, reducing electric system demand, improving electric system load factor, reducing electric system costs, and improving overall electric system efficiency and power quality.

The Ice Bear is installed "behind the meter," but the Ice Bear system was designed for the utility as a peak reduction grid asset, with most of the capacity, energy shift, and system cost deferral benefits flowing to the utility and the grid as a whole. Therefore Ice Bear projects are typically funded either directly via a capacity contract between Ice Energy and the utility, or indirectly through a utility-sponsored customer incentive program (which is less cost effective).

The Ice Bear's smart grid capabilities are enabled by a two-way communications network and a sophisticated, utility-compatible smart grid controller that controls the Ice Bear system, manages the connected rooftop packaged unit, and serves as an intelligent gateway for managing additional demand and consumption on installed buildings throughout a utility territory. In fact, The Ice Bear's on-board CoolData Controller received the highest ever score from Smart Grid News on its Smart Grid Scorecard.

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[1] A three-minute video on the opening page of Ice Energy's website provides a concise, user-friendly narrative on the operation of the Ice Bear. http://ice-energy.com/

Ice Energy's CoolData Control Network creates an aggregated utility resource that is interoperable, scalable, and dispatchable, providing utilities with the unprecedented ability to intelligently shape peak demand by managing the load profile of a single building, a feeder, a substation, a region or their entire grid, effectively creating an inside-the-meter virtual power plant. The utility can change dispatch schedules on-the-fly in response to changing system conditions, or it can simply set and consistently maintain a regular seasonal schedule to align with grid system load profiles.

This ability to aggregate and control thousands of individual units, and to bundle their performance as a single utility resource, enables a utility to utilize the Ice Bear solution for capacity and energy in the same manner as other bulk energy storage solutions.

Ice Energy, which has about 1,000 Ice Bears deployed in 40 different utility service territories nationwide, recently entered into an agreement with Southern California Edison to install 25.6 MW of Ice Bears in the SoCalEd service territory, adding to an additional 11 MW of peak capacity contracts with two public municipal utilities, Redding Electric Utility and Riverside Public Utility. The Ice Bear fleet is approaching 35 million hours of reliable operation.

In New England, Ice Energy currently has 31 Ice Bears installed and operating in the Boothbay Region within Central Maine Power's service territory as part of a non-transmission-alternative pilot program. The 31 "Boothbay Bears" are being remotely dispatched to shift 250 kilowatts of AC demand to off-peak hours, thus helping to relieve a utility distribution feeder line that would otherwise have needed to invest in upsizing to meet growing demand.

In January of 2016, Ice Energy introduced the Ice Bear 20, a smaller version of the original Ice Bear (now referred to as the Ice Bear 30). The Ice Bear 20 is designed to meet the needs of the residential market. Unlike the Ice Bear 30, the Ice Bear 20 will consist of an efficient round-the-clock AC unit equipped with a storage tank capable of operation for at least four hours per day. Thus, rather than installing an Ice Bear 20 *in addition to* a conventional AC unit (as with the Ice Bear 30), the Ice Bear 20 will *completely replace* an existing conventional residential unit, providing a 24-hour per day AC capability with at least 4 hours of controllable storage.

In New England, Ice Energy is represented by Thermal Energy Storage of Maine.

For additional information please contact either:

Greg Miller, Executive VP for Market Development, Ice Energy, gmiller@ice-energy.com or

Kim Kenway, VP, Thermal Energy Storage of Maine, kkenway@maine.rr.com

KEY CAPTURE ENERGY

January 27, 2016
Comments to Massachusetts Department of Energy Resources on Energy Storage Initiative

Key Capture Energy (KCE) is a utility-scale storage development company with a focus on the northeastern United States. KCE targets 10-50 MW projects with storage technologies that are the most economical at the time of deployment with respect to current market rules. KCE looks forward to working in State of Massachusetts.

KCE thanks the Department of Energy Resources (DOER) for the considerable thought gone into storage, and offers the following comments, as requested to Storage Stakeholders on December 27, 2016. DOER asks that respondents address storage scale, structure, and mechanisms for energy storage targets.

Scale

The target scale set by DOER should be set with three things in mind:

The target should be attainable
The target should incentivize getting projects in the ground sooner rather than later
The target should allow all cost-effective participants into the market.

We can learn from the SREC program in Massachusetts how a solid target works: it started modestly (400 MWs), and as developers responded and the benefits were established the target increased. But—while the SREC program was successful, it did not accomplish the third bullet, as it didn't allow in market participants over 6 MWs, who would've been able to provide SRECs at a considerable discount to the $280/SREC that Massachusetts granted – saving Massachusetts ratepayers considerable money.

KCE proposes that the target be 400 MWs to be installed by Jan 1, 2020, with a stronger focus on the Front of the Meter projects (FTM) that will be more cost-effective.

Structure

The State of Charge report is quite clear on the cost/benefit ratio for merchant FTM facilities: 3.00-4.40 (Table 3: Use Case Benefit-to-Cost Ratio). As such, Massachusetts should not preclude larger projects from participating, especially as to be able to participate fully in the ISO-NE wholesale market these projects must be at least 10 MWs.

The SREC program in Massachusetts has a REC price of ~$280/REC, but the recent winners of the Clean Energy RFP (including solar) received an estimated $20-30/REC[1]: clearly showing that bigger projects can have massive savings for ratepayers. As such, FTM projects should be encouraged by the Commonwealth.

While in the State of Charge report the Use Cases have an estimated share of the market (Table 3), KCE strongly encourages DOER to not make percentages binding. Instead, let the markets decide what has the most value by putting brackets around a few general categories (merchant FTM projects: 60%, Behind-The-Meter projects: 20%, Utility or Municipal Light Plant (MLP) owned projects: 20%). If the state wishes to encourage certain uses, such as storage + solar, there are other mechanisms to do so (such as the SREC III program). To codify these Use Case percentages will be detrimental to the market as developers adjust their projects to those arbitrary targets rather than optimize for the market at the time.

[1] *Connecticut Department of Energy and Environmental Protection Presentation to the Energy and Technology Committee Informational Meeting*. Jan 24, 2017, showing contracted bundled PPAs of energy and RECs for 8.48 c/kWh for the 2016 Large Scale procurement

KEY CAPTURE ENERGY

Additionally, the use cases studied are not the only use cases that exist: storage can exist as a peaker replacement, as alternatives to natural gas pipelines, and as combination with wind or other intermittent sources of electricity (and not just solar).

KCE encourages the state to minimize IOU ownership of storage systems, and to only allow IOU ownership in specialized cases to keep the lights on, such as when needed to integrate high penetration of distributed (localized) renewable generation. For all other cases, market deregulation should be respected.

Mechanism

No utility-scale (non-pilot) storage projects have been built in New England as the wholesale market is not set to allow entry. For instance, the primary revenue for many battery storage projects is frequency regulation. ISO-NE prices are roughly $10/MWh, compared to ~$25-30/MWh in PJM (where over 300 MWs of battery storage is installed)[2].

As the owners of battery storage are unable to monetize many of the benefits accrued to ratepayers (T&D cost reduction, reduced start up and shut down costs of traditional generators, lower compliance costs for GHG emissions, etc.), until there are reforms at ISO-NE, payment mechanisms must be created by the Commonwealth to enable storage projects to be built: namely, predictable, long-term revenues.

KCE suggests the following mechanisms for FTM storage systems contracting.

> For merchant projects, mandate the Electric Distribution Companies (EDCs) have set RFPs for storage projects. The long-term revenue from the EDCs should be the missing money necessary to get a project built. To ensure the storage developer operates the battery in the way that is best for the wholesale electricity market, the payments should be ($/MWh * month) for each month that the full capacity is online (note—this is not per MWh of energy generated, but rather for each MWh of potential – for instance, a 10 MW/40 MWh system would be paid $/MWh*40MWh per month for the winning bid). While there should be strict boundaries around this requirement to ensure that the storage system is being operated, it should be left to the battery operator to optimize the use cases of the battery to receive the highest merchant revenue.
>
> This way the wholesale market is respected, the batteries will be operated in the way that has the most revenue (and thus the most need) in the market, and the regulatory risk at the ISO-NE level is put on the developer rather than on the Commonwealth.
>
> If projects are to be owned by the IOUs or MLPs, there should be RFPs for those projects with the exact specifications needed (for instance, a 4 MW, 24 MWh storage system located within a wide geographic area), with the contract being a build-transfer model.

KCE thanks the DOER for the opportunity to provide these comments.

Jeff Bishop
Managing Director
jeff.bishop@keycaptureenergy.com

[2] *A Comparison of Policies on the Participation of Storage in U.S. Frequency Regulation Markets*. Xu et al, 16 Feb 2016. Paper presented at IEEE PES General Meeting 2016.

LISC
Boston

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, Massachusetts 02114

Via electronic mail to: Storage.DOER@massmail.state.ma.us

Re: LISC Boston's Stakeholder Comments on Energy Storage Procurements

Dear Commissioner Judson,

The Local Initiatives Support Corporation (LISC) is pleased to provide comments to the Massachusetts Department of Energy Resources (DOER) in Round Two of stakeholder comments in support of its decision to adopt targets for energy utility storage procurement, as per An Act to Promote Energy Diversity, Chapter 188 of the Acts of 2016 ("Energy Diversity Acts").

LISC Boston is the local affiliate of Local Initiatives Support Corporation (LISC), a national community development intermediary. LISC believes that everyone should have the right to live in a safe, prosperous neighborhood full of opportunities. With this as our guiding vision, LISC is working to create "Sustainable Communities" that are good places to live, do business, work and raise families. LISC pursues five strategies toward this vision for our communities: 1. Developing, preserving and investing in the physical environment. 2. Increasing family income and wealth. 3. Stimulating economic activity. 4. Improving access to quality education. 5. Fostering livable, safe and healthy environments. LISC Boston's Green Retrofit Initiative (GRI) has a strong track record running a statewide technical assistance program to help owners of affordable housing stabilize operating costs, decrease greenhouse gas emissions, and provide residents with a higher quality of life through energy efficiency and healthy housing improvements.

In order to avoid repetition, LISC Boston supports the in-depth comments provided by the Clean Energy Group. We also offer the following additional comments:

- We firmly believe that multifamily affordable housing should be considered as "critical infrastructure" just like hospitals, wastewater treatment plants and other at-risk facilities. Affordable housing serves some of the most vulnerable populations in the state such as elderly residents, formerly homeless, and low-income families. Through our GRI program, we have worked to increase collaborative efforts among utilities and the state's housing finance agencies. We are building upon that work in our Massachusetts Clean Energy Center grant to identify the most applicable renewable technologies for projects approaching recapitalization/rehabilitation. We believe all residents of the state, not just affluent households, should benefit from the clean energy economy.

- LISC Boston believes it is important to learn from the experience of our peers. In particular, the New York City Housing Authority had hundreds of buildings severely impacted by Superstorm Sandy (https://www1.nyc.gov/site/nycha/about/recovery-resiliency.page) in which residents were left with no heat, hot water, and electricity for long periods of time. We urge DOER to support the activity of LISC and other organizations that are seeking clean energy solutions that could avoid such a disaster in Massachusetts.

- In order to create a market for energy storage in multifamily affordable housing, it is important that separate, mandated utility procurement targets be created for "behind the meter" systems owned by multifamily affordable housing providers or financed by third party entities. Behind the meter clean energy and storage can provide meaningful benefits to owners that have properties, which operate on razor-thin budgets, and the residents they serve. Utilities should not simply be given a capacity target; there should be guidelines on procurement and a clear pathway for at-risk facilities on the ground to incorporate energy storage technology.

In summary, we believe it is crucial for the state to provide a viable pathway for owners to incorporate storage in affordable projects housing the state's most vulnerable populations.

Sincerely,

Bob Van Meter
Executive Director, LISC Boston

Mike Davis, AICP, LEED AP BD+C
Senior Program Officer, LISC Boston

mosaic power

State of Massachusetts

Department of Energy Resources

Comments on Massachusetts Energy Storage Target

Mosaic Power, LLC ("Mosaic") is a community energy storage business based in Frederick, Maryland. Mosaic utilizes the energy storage potential of existing, regular electric water heaters to manage their electricity demand according to the needs of the electric grid. Mosaic manages water heater electricity demand in the states of Maryland, Ohio, Virginia, and West Virginia as well as the District of Columbia as a part of PJM Interconnection's ("PJM") Frequency Regulation Market.

Mosaic's Water Heater Efficiency Network ("WHEN") is a secure network that optimizes the timing of electricity use by nearly 7,000 electric water heaters in the above states. The network synchronizes the demand of connected water heaters with the minute-by-minute needs of the electric grid. This network can utilize electric water heaters to provide both load shifting and frequency regulation services to the electric grid.

Mosaic would like to encourage the Massachusetts Department of Energy Resources (DOER) to adopt an aggressive energy storage target. Mosaic does not have a specific target for energy storage in Massachusetts to support, but rather has two specific areas of comments.

The Need to Consider Thermal Storage

Mosaic encourages Massachusetts to consider of the full array of energy storage technologies to meet its energy storage target. Often, energy storage conversations focus on large scale batteries while missing the benefits of thermal storage

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potential. Mosaic has, for the past three years, utilized the thermal energy storage potential of electric water heaters across PJM's territory to provide frequency regulation and there is great potential to utilize the thermal storage potential of water heaters in Massachusetts.

Mosaic has found that water heaters can be operated without decreasing their efficiency to bring their electricity demand in tune with the needs of the electric grid. Used in this manner, water heaters provide a 100% efficient energy storage resource. A large fleet of electric water heaters can be intelligently managed, without impacting users, to provide multiple services including frequency regulation and load shifting services. Utilizing the storage potential of water heaters offers a nearly carbon free method to smooth demand and generation and to reduce peak hours of demand. The intelligent management of electric water heaters also allows for the potential to integrate the large potential of renewable energy by using a resource that already exists in the field.

Mosaic's approach is to add our equipment to existing water heaters and issue rebate payments to participants. Water heaters offer non-traditional benefits as well as Mosaic has found that rebate payments to connected affordable housing properties have been used to reduce tenant rent, purchase property-wide LED lighting, and to make other property upgrades. Mosaic has found, through experience, that the only way to connect large numbers of water heaters is to maintain tenant comfort. Mosaic's systems are invisible by the user as we use demand monitoring and predictive analytics to ensure tenant comfort. Electric water heaters are already in closets and basements in single and multi-family homes waiting to be utilized.

Water heaters and other thermal storage technologies should be considered as Massachusetts plans how to meet and exceed any energy storage target.

The Need to Consider Fair Pricing

Mosaic believes a primary barrier to the commercial deployment of distributed energy resources is the formation of rational prices in competitive markets. Mosaic would like to encourage the DOER as well as the New England ISO (NE-ISO) to fully consider the need for fair pricing mechanisms that allow for the growth of a diverse energy storage services.

Distributed energy resources, specifically storage and demand technologies, have marginal costs that approximate zero. As the penetration of these low-cost solutions rises, the natural result is a decline in prices to the marginal level of

approximately zero. This dynamic is fundamental to the power market where reliability requirements dictate surplus capacity. However, the predominant solutions to this missing money problem is to ensure that a basket of services can, as a whole, meet the operational and financial costs of operating a resource. This basket of services model assumes resources can provide all the services, which is clearly not the case with emerging technologies.

Mosaic suggests a better model is one where the required services are unbundled, and each service can stand on its own, with pricing that reflects marginal and fixed costs sufficient for long term market stability. With the removal of cross-subsidies, the lowest all-in cost solutions for each specific grid service can be discovered and commercially deployed. For the long-term sustainability, storage should be able to be self-finance by providing valuable services into a fair market. Without such fair market solutions, energy storage will require out-of-the-market payments such as grants, portfolio requirements, and/or direct subsidies to compete.

Conclusion

Mosaic fully supports an aggressive energy storage target for the state of Massachusetts, without comment on a specific target. Independent of the specific target set, Massachusetts must have a fair market where diverse energy storage technologies, specifically thermal storage, can operate to meet and exceed the specific storage target.

FirstLight™
Power Resources

January 27, 2017

Massachusetts Department of Energy Resources

Introduction

FirstLight Power Resources (FLPR) is a Massachusetts company that owns and operates a strong portfolio of hydroelectric generation, electric storage, and Class I renewable energy generation. FLPR's New England generation fleet includes run-of-river hydro-electric facilities, pumped storage hydroelectric facilities, traditional hydroelectric facilities, and a solar farm. Our facilities, located primarily in Massachusetts and Connecticut, represent over a billion dollars in investment, direct employment of approximately one hundred twenty-five (125) people in the region and local property taxes of over $16,000,000.

FLPR appreciates the opportunity to submit written comments in response to the Department of Energy Resources' (DOER) request for stakeholder comments on energy storage targets for the Commonwealth. In August 2016, Governor Baker signed into law "An Act Relative to Energy Diversity", Chapter 188 of the Acts of 2016. Upon its determination "to set appropriate targets for electric companies to procure viable and cost-effective energy storage systems to be achieved by January 1, 2020", Section 15(a) of the Act requires the DOER to consider "...a variety of policies to encourage the cost-effective deployment of energy storage systems...". The DOER has determined that it will set targets for the procurement of energy storage systems and is seeking feedback from stakeholders on "the appropriate target scale, structure, and mechanisms for the energy storage systems targets by July 1, 2017."[1]

Comments

In response to this DOER request, FLPR offers the following comments to assist DOER's further efforts. Under the Act, energy storage systems are defined as *"a commercially available technology that is capable of absorbing energy, storing it for a period of time and thereafter dispatching the energy and which may be owned by an electric distribution company; provided, however, that an energy storage system shall: (i) reduce the emission of greenhouse gases; (ii) reduce demand for peak electrical generation; (iii) defer or substitute for an investment in generation, transmission or distribution assets; or (iv) improve the reliable operation of the electrical transmission or distribution grid; and provided further, that an energy storage system shall: (1) use mechanical, chemical or thermal processes to store energy that was generated for*

[1] Massachusetts Department of Energy Resources "Letter to Conferees Storage Target" dated December 27, 2016.

use at a later time; (2) store thermal energy for direct heating or cooling use at a later time in a manner that avoids the need to use electricity at that later time; (3) use mechanical, chemical or thermal processes to store energy generated from renewable resources for use at a later time; or (4) use mechanical, chemical or thermal processes to capture or harness waste electricity and to store the waste electricity generated from mechanical processes for delivery at a later time.".

While DOER's "State of Charge" report, which appears to be the guiding document for DOER's policy development under this proceeding, is focused almost exclusively on the development of new electric storage technologies, FLPR notes that this definition also includes traditional energy storage technologies like pumped storage hydro. The "State of Charge" report concluded that new pumped storage was unlikely to be built in New England and therefore did not warrant further assessment in the report and its underlying study, yet its presence in New England is important to the consideration of storage targets in the Commonwealth.[2] Importantly, this existing grid scale electric storage can play an important role in upcoming efforts to procure significant new Class I renewable generation and clean energy imports under the Act. While Massachusetts consumers may today derive some incidental value from this existing storage through the ISO New England spot wholesale markets, much greater value for Massachusetts consumers is possible under the storage pairing provisions of the planned clean energy procurements.

In the following comments, FLPR has structured its feedback to be consistent with the "State of Charge" report segments.

Wholesale Grid Scale

Significant grid-level storage already exists in the three pumped storage facilities in New England as well as a recent battery installation in the State of Maine. The two largest of these electric storage facilities are located in Massachusetts. The New England wholesale grid has the opportunity to benefit from these existing installations of over 1,800 MWs of energy storage with a combined energy storage capability of more than 15,000 MWhs.[3] To put this in perspective, this is the equivalent of 257,000 Tesla Power Walls (at 7kW maximum discharge rating per unit) on an installed megawatt basis or over 1.1 million Tesla Powerwalls (at 13.5kWh maximum storage per unit) measured on a stored energy basis.[4] These existing pumped storage

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[2] Massachusetts Department of Energy Resources, "State of Charge: Massachusetts' Energy Storage Initiative", page V http://www.mass.gov/eea/docs/doer/state-of-charge-report.pdf.

[3] The three pumped storage facilities are Northfield Mountain (1168MW) and Bear Swamp (600MW) (Emera Energy, http://www.emeraenergy.com/en/home/assets/pumped-storage.aspx), both in Massachusetts, Rocky River (29MW) in Connecticut and the recent battery (16.2MW) installation in Yarmouth, Maine (Portland Press Herald, December 17, 2016, http://www.pressherald.com/2016/12/17/yarmouth-power-plant-installs-giant-battery-in-first-of-its-kind-project-in-new-england/).

[4] Information from Business Insider article titled "Tesla just unveiled its new-at-home battery – here's what you need to know" dated October 31, 2016. http://www.businessinsider.com/everything-about-tesla-powerwall-2-battery-2016-10/#in-2015-tesla-unveiled-the-powerwall-a-rechargeable-lithium-ion-battery-weighing-roughly-200-pounds-that-you-can-mount-on-your-wall-panasonic-makes-the-cells-for-the-powerwall-while-tesla-builds-the-battery-module-and-pack-1

hydro facilities currently operate in response to ISO New England (ISO-NE) wholesale markets for energy and ancillary services. However, all storage facilities, including pumped storage, face considerable uncertainty in determining the energy discharge and energy consumption bids into the ISO-NE energy markets necessary to capture energy arbitrage economics (i.e., capture differences between lower Locational Marginal Price (LMP) hours and higher LMP hours within and across days). Given this uncertainty, under current day-ahead and real-time energy spot market pricing signals, about one-third of the daily energy storage throughput capability is used on average. This leaves an additional two-thirds of the daily storage capability opportunity to provide further economics to Massachusetts consumers.[5] Using a four-hour battery duration assumption, this additional storage opportunity at existing installations is the equivalent of 2,500 MWhs of incremental storage.[6]

To the degree that DOER analysis reveals that incremental storage may present additional energy and ancillary service savings, FLPR encourages DOER evaluations to first target greater utilization of this existing storage capability before setting targets for incremental investments, particularly where consumers may take on all or part of such investment risks, in energy storage systems at the grid-level. [7]

Opportunity to increase the utilization of these existing resources and obtain greater value for consumers exists in the upcoming RFP for clean energy and renewable Class I generation. Section 83D expressly requires electric distribution companies to consider arrangements that include paired energy storage, indicating legislative recognition of the value of storage pairing, including by existing storage.[8] The statutory language includes existing pumped storage resources as eligible paired storage resources.

Distribution – Connected Storage

Given that the specific local value of distribution-connected storage includes the ability to improve distribution system reliability, decrease distribution system losses, and avoid future distribution system upgrades, it would seem that any evaluation of a target for this segment needs to be informed by the extent of opportunity that currently exists in the current state of the distribution systems in Massachusetts (e.g., extent and magnitude of reliability issues, etc.). Massachusetts Electric Distribution Companies should be directed to report the extent and magnitude of these conditions on their distribution systems to inform DOER storage target efforts.

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[5] Information based on the operation of the Northfield Mountain pumped storage facility in the ISO New England market.

[6] Two thirds of 16,000MWs divided by 4-hour charge duration.

[7] At page 10 of the Energy Storage Association (ESA) comments submitted to the DOER on December 16, 2017, ESA states "as Massachusetts seeks higher level of renewables, there may be diminishing returns to the greenhouse gas reductions of those sources if they do not displace more emission-intensive sources such as are used in peak periods."

[8] Section 83D of Chapter 169 of the Acts of 2008, as amended by Chapter 188 of the Acts of 2016, An Act to Promote Energy Diversity.

Behind-the-Meter/Multiple Use Storage

A lot of focus has been given to energy storage systems located behind the customer's meter given the attraction of storage developers to stacked or multiple uses of such storage devices to simultaneously sell wholesale energy services, distribution system level services and end-use level services (e.g., provide demand charge reductions and back-up power to the customer). However, before the DOER establishes a target quantity for this category of storage entry, FLPR suggests the DOER (i) first evaluate the complications, if any, of serving multiple levels of service, and (ii) remove the disincentive for storage embedded in net metering design (and possibly its successor).[9] For an example of the former, if a behind-the-meter storage device energy discharge is to serve part of the customer's retail demand, how does that impact the ability of such storage device to have its charging energy qualify for wholesale rate treatment? Specifically, a grid-connected storage resource charges by buying energy at wholesale rates because the charging energy consumed is solely for purposes of subsequent discharge for wholesale energy sale (e.g., day ahead or real-time energy market sale in ISO-NE), a sale for resale. It is important to recognize that where a storage resource is used for stacked services which include discharge for end-use consumption (e.g., to serve customer load during the peak demand hour to decrease utility demand charges), the storage charging for that resource may not be considered a wholesale transaction and consequently the charging energy would not be a wholesale energy transaction. This could significantly impact the economics of such installations because the cost of storing energy could make the behind-the-meter-level sale of such stored energy uneconomic.

General Considerations

In addition to the above considerations, FLPR encourages the DOER to consider other factors such as the stage of individual storage technology development and the future opportunity for improvement in their installed costs. Industry articles identify expectations of significant cost reductions in advanced technology storage in coming years.[10] It may be prudent to hold the option to obligate consumers to large, additional storage targets now versus locking costs in at higher current day costs. Further, FLPR encourages DOER to also consider the opportunity for competitive market investments that do not require consumers to bear the investment risk. We address each below:

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[9] Since solar net metering credits can be used for any kilowatt-hours of that customer's demand, there is no value for that customer to install storage since the Electric Distribution Company's system is used for that purpose. Even if, as proposed by DOER, the credit for solar generation is converted to a flat cents per kilowatt-hour rate, the same disincentive exists. This is evidenced by SolarCity and Tesla joint comments submitted to the DOER on December 16, 2017 which indicates that there is "significant disparity between real-time values on the electricity system and customer rates that reflect averaged costs prevents customers and third parties from deploying energy storage resources that would create system-wide savings."(page 2)

[10] The United States Department of Energy September 2016 publication "Revolution...Now" states at page 16 that "(t)he lithium-ion battery packs used in the majority of grid-connected batteries have declined in cost by about 60% between 2007 and 2014 [40] and analysts expect both utility and consumer scale batteries to decline in cost by another 20-27% in just the next two years."

- **Opportunity for lower battery storage costs in future years** – Several of the intervenors in the December 16, 2016 DOER docket cited sources indicating significant reductions in equipment costs in future years attributed to progress in technology and manufacturing processes. While higher current costs might be acceptable for purposes of a small scale series of pilots to investigate the value and complications of storage use at the distribution grid and customer sited locations, they may not be prudent for a larger quantity of ratepayer investments.[11]
- **Avoid harm to economic signals that exist today** – Several intervenors have cited specific circumstances where current technology battery storage is economic.[12] Signaling opportunity for subsidy risks that storage developers will defer economic investment opportunities to maintain the option to get that additional compensation to provide even greater gains.
- **Learning by doing means smaller initial investment** – If, as many intervenors in the December 16th docket indicated, targets may be necessary to trigger "learning by doing", this necessarily means there is value to obtaining further education on the values, complications, and barriers to battery storage before committing ratepayers to significant investments. The EDC's comments supported this approach by identifying "aspirational" targets that do not require ratepayers to be exposed to large investment costs before the region better appreciates the impact of these factors on the value to consumers.[13] The worst outcome for consumers would be investing vast amounts of their money in a large target only to find significant complications or barriers that prevent them from realizing the offsetting value.

[11] With over 1,800MWs of installed pumped storage on the transmission grid, there is significant experience and opportunity that can be obtained from the operation of those facilities today.
[12] Pika December 16, 2016 comments submitted to the DOER state "(i)t would be less costly for the business to power their emergency lights from a battery-backed rooftop PV system than to install and maintain dozens of individually battery-powered lighting units."
[13] Joint Distribution Companies Input to DOER on an Energy Storage Target at p.4 (December 16, 2017).

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January 27, 2017

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
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RE: Comments addressing the appropriate target scale, structure and mechanisms for energy storage system targets

Dear Commissioner Judson,

Brookfield Renewable Partners (Brookfield) submits these comments in response to the Department's December 27, 2016 request for comments on the appropriate target scale, structure and mechanisms for energy storage system targets in Massachusetts.

Brookfield has a strong presence in New England, with over 1,200 MW of hydropower and storage, almost 100 MW of wind assets, and a long track record of providing clean, renewable and reliable power. In Massachusetts, our facilities include a 600 MW hydroelectric pumped storage facility (Bear Swamp), a 10 MW hydroelectric facility (Fife Brook), our North American System Control Center located in Marlborough and our U.S. headquarters in Boston.

Brookfield strongly supports the efforts undertaken by Massachusetts to reduce GHG emissions from electricity generation and to promote clean electricity sources, including support for energy storage resources. We believe that a diversity of storage resources will be critical for the Department's energy storage targets to be successful. As new distributed storage technologies continue to evolve, it is essential that any energy storage standard incorporate and utilize existing, large-scale storage resources.

Fast ramping grid-scale pumped hydro storage facilities, including our Bear Swamp resource, are a critical piece of integrating the growing fleet of intermittent renewables, enabling the region's transformation to a more dynamic electric grid and achieving the Commonwealth's renewable energy and carbon reduction goals. Such facilities historically provide a high level of performance on a wide array of electricity products needed to maintain system reliability. They also are a proven, long-life technology capable of responding to changing system needs with increasingly faster timespans while making products like frequency regulation and system surplus energy absorption even more readily accessible and valuable. In contrast, grid scale battery storage technologies may not provide the same ability to frequently ramp up or down during the day without severe degradation in life expectancy. Therefore a diversity of storage resources in Massachusetts, including pumped hydro storage, is highly desirable.

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Brookfield is currently considering upgrades to and improved efficiencies at our Bear Swamp facility, including replacing two turbines which were originally placed into service in the 1970s and are still operating today. The upgrade has the potential to increase the nameplate capability of each machine by ~30MW, which would achieve a 10% total capacity increase and a total station capability of ~660MW.

This upgrade would not only be highly competitive with other storage resources, it would also create new large-scale storage capacity directly interconnected within Massachusetts; increase efficiencies in both the generation and pumping cycle; produce valuable new incremental electrical generating capacity at a time of need; enable increased storage of intermittent renewables in times of surplus, as well as increased overall penetrations of renewable generation in the region; and provide more timely responses to changing system needs. Importantly, we believe these benefits can be delivered to the market at lower costs relative to the exclusive development of entirely new, smaller scale resources, helping deliver more cost effective energy storage solutions to ratepayers and enhancing long-term reliability within the Commonwealth even as significant new intermittent offshore wind generation is interconnected. Massachusetts should appropriately value the full diversity of potential storage resources to maximize the benefits to the Commonwealth.

To maximize the benefits and cost-effectiveness of storage targets and associated procurements, Brookfield urges the DOER to:

1. Include incremental capacity increases developed at existing pumped storage under the energy storage system targets, as well as any procurements that may result in the blending of storage and renewable resources (such as associated with offshore wind development); and,
2. Enable separate procurement that specifically values and compensates bundling of existing pumped storage as part of the future procurement of non-emitting energy such as solar or wind. This type of a product would enhance non-emitting production of energy, while also enhancing reliability on the system given the intermittency of some renewable power and the complimentary nature of the pumped storage hydro facilities. This could be pursued as part of the Commonwealth's upcoming offshore wind procurement.

With regard to scale, Brookfield recommends that DOER adopt a total incremental energy storage target commensurate with the level of new intermittent renewable resources procured. This total target should represent at least 100 MW of new incremental storage capacity for the Commonwealth, including the potential for large-scale pumped storage upgrades. This minimum level would best encourage new development of what is likely to be immediately-available storage resources to Massachusetts.

Under all circumstances, Brookfield urges DOER to preserve technology-neutrality with any standard, allowing all qualifying resources to compete under the same terms and conditions within a market construct. This will incent market participants to drive efficiencies and cost-savings across all storage technology types and avoid market distortions, creating ratepayers benefits. Additionally, in order to

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preserve a fully deregulated market place and eliminate any incentive for self-dealing, Brookfield recommends implementing a standard wherein a Transmission Owner and its affiliates are prohibited from owning storage systems. Adoption of these principles will avoid the potential for cross-subsidization and increased ratepayer costs while ensuring a level playing field, fair market competition and fair compensation for all resources delivering the same storage service or product.

By setting a clear and transparent standard that incents the broadest possible participation from energy storage resources regardless of their type or vintage, the DOER can drive businesses to invest in new storage technologies, as well as upgrade and maintain existing facilities, enabling the Commonwealth to achieve its GWSA targets more quickly and cost-effectively. The inclusion and recognition of incremental grid-scale pumped hydro storage in any standard will deliver additional emission-free generation during peak system demand, balance intermittent renewables and enable more timely responses to changing system needs. It will also help ensure the successful integration of offshore wind generation to be pursued under the Commonwealth's recent clean energy legislation.

In short, pumped storage -- both incremental upgrades on their own, and existing pumped storage in combination with new renewables -- is uniquely suited to provide solutions that will enable the Commonwealth to achieve its carbon reduction goals in the most cost-effective way possible, while also maintaining a reliable, dynamic and decarbonized regional electric grid. A diversity of storage resources, including pumped storage and the development of new, cost-effective distributed storage technologies, will provide the maximum benefits for Massachusetts.

Thank you for the opportunity to comment.

Sincerely,

Jon Norman
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HQUS

A subsidiary of Hydro-Québec

January 27, 2017

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

Dear Commissioner Judson:

HQUS is pleased to provide these comments in the ongoing stakeholder process to determine the appropriate target for energy storage systems to be procured in the Commonwealth.

HQUS is the US subsidiary of Hydro-Québec. As you are aware, Hydro-Québec is a large supplier of clean energy, operates one of the largest transmission systems in North America and has several interconnections with Northeast power systems, including with the New England grid. In addition, through a joint venture with Sony, called Estallion Technologies, Hydro-Québec has been actively involved in the development of safe and reliable large-scale energy storage systems. It is from this perspective that we offer some initial comments on the Commonwealth's Energy Storage Initiative.

Hydro-Québec shares the vision that flexibility is an increasingly important attribute for the New England power system. As documented in the DOER's 2016 State of Charge report, 600 MW (and more) of energy storage can offer numerous benefits to power system reliability and efficiency and ultimately to customers.

In implementing a 600 MW energy storage target, Hydro-Québec urges three important program elements. The first is a sequential deployment plan. It will be important to phase in the addition of energy storage systems on the grid to validate and ensure success in terms of grid connection, operation, stability, integration with renewable resources and customer experience and acceptance. The second is inclusion of a variety

of formats, use cases and sizes for energy storage devices. Behind the meter, commercial and industrial applications and utility scale storage should all be eligible to participate. In this regard, while Hydro-Québec understands that this effort is focused on advanced energy storage technologies, traditional storage technologies like large hydropower supported by reservoirs and dispatchable HVDC transmission technology can also serve to cost-effectively store renewable energy during low demand periods and deliver it during peak periods. We urge the Commonwealth to consider how proposals from these traditional technologies might contribute to the Commonwealth's storage and renewable energy integration needs. Finally, Massachusetts should rely on a competitive process to procure energy storage systems. This will allow for consideration of as many options as possible and will achieve the most cost-effective outcomes for customers.

With respect to the performance of the types of energy storage technology being sought by Massachusetts, Hydro-Québec suggests that there should be standards and/or requirements for security and safety, particularly where storage devices are installed close to demand centers. In addition, the value analysis of proposals for advanced energy storage must take into account the longevity of the device. For example, the total cost of a system is optimized if a battery has a longer lifecycle with sustained performance compared to a low upfront battery unit cost with a limited lifecycle.

Hydro-Québec appreciates the opportunity to comment through this stakeholder process and would be pleased to provide additional information upon request.

Sincerely,

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January 27, 2017

By email

Will Lauwers
Director, Emerging Technology Director
Department of Energy Resources
100 Cambridge St., Suite 1020
Boston, MA 02114

Subject: Issues for Stakeholder Comment on Energy Storage Targets

Mr. Lauwers:

In response to the Department of Energy Resources' (DOER) December 27, 2016, request for input on implementation of An Act Relative to Energy Diversity, Chapter 188 of the Acts of 2016, RENEW respectfully submits these comments.[1]

RENEW Northeast, Inc. (RENEW) is a non-profit association uniting environmental advocates and the renewable energy industry whose mission involves coordinating the ideas and resources of its members with the goal of increasing environmentally sustainable energy generation in the Northeast from the region's abundant, indigenous renewable resources. RENEW has focused on highlighting the value of grid-scale renewable resources- specifically offshore and onshore wind, solar and hydropower- and the benefits of transmission investment to deliver renewable energy to load centers in the Northeast. RENEW members own and/or are developing large-scale renewable energy projects, battery and pumped energy storage systems, and high-voltage transmission facilities across the Northeast. They are supported by members providing engineering, procurement & construction services in the development of these projects and members that supply them with multi-megawatt class wind turbines.

RENEW members develop, construct, and/or own energy storage systems in Massachusetts and other jurisdictions, and have proposed projects in New England.

[1] The comments expressed herein represent the views of RENEW and not necessarily those of any particular member of RENEW.

RENEW makes the following recommendations on the target scale, structure, and mechanisms for energy storage system goals in the Commonwealth.

Target Scale

As Massachusetts continues its transition to a clean energy economy, utility-scale energy storage will need to be part of the solution. While New England is nowhere near the renewable energy penetration levels where curtailment is significant, studies show the benefits of adding energy storage to support renewable resources. For example, one studied determined that with just 5 percent additional system capacity added as storage, curtailment can be reduced to as low as 20 percent.[2]

RENEW submits DOER should set a target of 600 MWs to be contracted by January 1, 2020, with projects to attain commercial operation by January 1, 2022, slightly accelerating the policy recommendation in the *State of Charge* report for 600 MWs of advanced energy storage in the Commonwealth by 2025.[3]

Six hundred megawatts, constructed in the next five years, is eminently achievable and will accelerate the ratepayer benefits listed in the *State of Charge* report. Massachusetts can look to California for an understanding on how quickly these projects can be developed, constructed, and moved into operation, with two recent projects being contracted in September 2016 expected to be constructed in the winter of 2016/2017.[4]

Structure

In the *State of Charge* report, Massachusetts lists use cases for utility-scale storage projects that involve Investor Owned Utility Grid Mod Asset, Municipal Light Plant Asset, Load Serving Entity / Competitive Electricity Supplier Portfolio Optimization, and merchant projects, including Alternative Technology Regulation Resource, Storage + Solar, and Stand-alone Storage or Co-Located with Traditional Power Plant.[5]

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[2] Paul Denholm, et. al., *The Role of energy storage with renewable electricity generation*, National Renewable Energy Laboratory 41 (January, 2010), http://www.nrel.gov/docs/fy10osti/47187.pdf

[3] Massachusetts Department of Energy Resources et. al., *State of Charge Massachusetts Energy Storage Initiative* 5 (2016) ("*State of Charge*").

[4] Marianne Boust, *AES, AMS and Stem largest contract winners of SCE's energy storage procurement plans in 2016,* IHS Technology (September 16, 2016), https://technology.ihs.com/583596/aes-ams-and-stem-largest-contract-winner-of-sces-energy-storage-procurement-plans-in-2016

[5] *State of Charge*, Table 2

There are use cases that were not studied, but should be allowed in any future solicitation, including:

Storage + Wind – An offshore wind facility to be built off Long Island, New York, will combine offshore wind energy with new on-island energy storage.[6] One developer submitted a bid in the Clean Energy RFP that included energy storage as part of a broader package with utility-scale wind and solar.[7]

Peaker Replacement – Energy storage is available now to replace natural gas peaker plants – both existing and planned. For instance, in California, AES Energy Storage is building a 100 MW, 400 MWh lithium ion battery complex for Southern California Edison meant to be a peaker replacement.[8]

Natural Gas Pipeline Alternative – When a massive gas leak occurred in California, state regulators fast-tracked procurements of storage,[9] authorizing procurement of 37.5 MW, 150 MWh of battery storage built by AES for San Diego Gas & Electric. If Massachusetts would like to ensure reliability of resources without new pipelines that will cause Massachusetts to miss its Global Warming Solutions Act greenhouse gas reduction requirements,[10] then utility-scale storage can be part of the solution.

Incremental Energy from Existing Storage – The Bear Swamp facility in Massachusetts, for example, is currently considering upgrades and improved efficiencies, including replacing two turbines which were originally placed into service in the 1970s and are still operating today. The upgrade has the potential to increase the nameplate

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[6] Deepwater Wind, *Deepwater Wind Proposes Innovative Offshore Wind, Energy Storage Solution to Meet Growing Energy Demand on Long Island's South Fork* (December 8, 2015), http://dwwind.com/press/deepwater-wind-proposes-innovative-offshore-wind-energy-storage-solution-to-meet-growing-energy-demand-on-long-islands-south-fork/

[7] New England Clean Energy RFP, https://cleanenergyrfp.com/bids/

[8] Jeff St. John, *How Energy Storage Can Cut Peaker-Plant Carbon for the Clean Power Plan*, Greentech Media (September 24, 2015), https://www.greentechmedia.com/articles/read/how-energy-storage-can-cut-peaker-plant-carbon-for-the-clean-power-plan

[9] Peter Maloney, *Blackouts looming, California speeds battery deployment after Aliso Canyon gas leak*, Utility Dive (August 11, 2016), http://www.utilitydive.com/news/blackouts-looming-california-speeds-battery-deployment-after-aliso-canyon/424241/

[10] A business as usual approach of adding more natural gas fuel generators will cause states to miss GHG reduction requirements. *See* ISO New England, *2016 Economic Studies Draft Result – Part II*, 106-113 (September 21, 2016), https://www.iso-ne.com/static-assets/documents/2016/09/a6_2016_economic_study_draft_results_part_2.pdf

capability of each machine by ~30 MWs, which would achieve a 10 percent total capacity increase and a total station capability of ~660 MWs.

When considering the target, RENEW encourages DOER to allow for full participation from utility-scale storage projects. As stated in the *State of Charge* report's information on Use Case Benefit-to-Cost Ratio,[11] utility-scale projects have benefit/cost ratios of 3.00-4.40 for merchant facilities, and from 2.04-4.06 for LSEs, IOUS, and MLPs. By contrast, Behind-the-Meter (BTM) project ratios of 0.49-2.43 ratios make the case for robust deployment of larger projects. Minimizing the deployment of large-scale energy storage, as was done to the large-scale solar in its initial years, would be a mistake. Until last year, lower cost large-scale solar projects were effectively barred from participating in the solar carve-out in the Commonwealth, as the only viable program, SRECs, limited project size to 6 MW DC or less per parcel of land.[12] Utility-scale solar projects could compete in Massachusetts only when Massachusetts participated in the 2016 Clean Energy RFP.[13] While BTM storage provides valuable benefits to local reliability that supports its widespread deployment, the strategy for energy storage should seek to provide balance on cost by including a substantial component of lower cost large-scale storage.

Large-scale energy storage resources can also monetize their benefits in ways BTM cannot. Under ISO New England's (ISO) current rules, storage units, to participate in the wholesale market, must be above 10 MWs to provide and be compensated for regulation services for an hour duration.[14] While this cap might be lowered in the future, only larger energy storage resources are likely to be engaged in the ISO markets given the cost and complexity to be a market participant. To provide the most ratepayer benefits and to allow for full participation in the wholesale markets, energy storage projects in Massachusetts should not have an upper capacity limit as was mandated in the SREC program with its 6 MW cap.

Mechanisms

RENEW recommends that DOER mandate direct solicitations by the electric distribution companies (EDCs) and municipal light plants (MLPs), with cost-recovery for the EDCs, that

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[11] *State of Charge,* Table 3

[12] http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/solar/rps-solar-carve-out-2/about-solar-carve-out-ii.html

[13] New England Clean Energy RFP, https://cleanenergyrfp.com/2016/10/25/bidders-selected-for-contract-negotiation/

[14] Eric Johnson, *How Energy Storage Can Participate in New England's Wholesale Electricity Markets*, ISO New England, 10 (March 31, 2016), https://www.iso-ne.com/static-assets/documents/2016/01/final_storage_letter_cover_paper.pdf.

includes:

- **Energy Storage Contracts**. Either competitive RFPs or appropriately priced set amounts should be paid for the ratepayer benefits that cannot be monetized by the storage operator, including reduced peak capacity payments, wholesale market cost reductions, or T&D cost reductions. These contracts should be long-term (10-20 years) to ensure that merchant batteries can be financed; and

- **Storage build-transfer contracts**: For the IOU-owned and MLP use cases, EDCs should issue competitive RFPs and sign bilateral contracts for build-transfer.

  While Table 3 in the State of Charge suggests a IOU and MLP ownership percentage of 50 percent, RENEW encourages DOER to consider a lower amount, and only for certain use cases. For instance, distributed storage at utility substation can be owned and operated by Independent Power Producers (IPPs), that have a clear incentive to operate storage projects in a manner the ISO values highest (thus corresponding to higher revenues): this will both keep the wholesale market intact, as well as ensure the best storage technologies are deployed and are operated effectively.

Other Remarks – ISO New England Market Rules

RENEW recommends DOER be firmly involved in the changes that are needed in the ISO market rules to ensure full participation of energy storage- including legacy pump storage- in the wholesale markets. There is a strong need for consideration of the role of energy storage in conversations occurring in NEPOOL's Integrating Markets and Public Policy initiative. Questions need to be answered there on how battery storage and pumped storage can better participate in the energy, capacity, and ancillary services markets. Once the Federal Energy Regulatory Commission (FERC) adopts rules on energy storage based on the proposed rules now out for comment, DOER and energy storage stakeholders will need to ensure ISO market rule changes comply with FERC's goal of more effectively integrating electric storage resources into organized wholesale markets to encourage competition and ensuring those rules provide just and reasonable rates.

RENEW appreciates the opportunity to offer these comments.

Sincerely,

Francis Pullaro
Executive Director

SIERRA CLUB
Massachusetts Chapter

January 27, 2017

Massachusetts Department of Energy Resources
100 Cambridge St. Suite 1020
Boston, MA 02114 US
Storage.DOER@massmail.state.ma.us
Attn: Will Lauwers, Director, Emerging Technology Director

Re: Energy Storage Stakeholder Target Input Request, November 16, 2016

Dear Sir or Madam:

The Massachusetts Sierra Club[1] thanks you for the opportunity to submit additional comments regarding the appropriate scale, structure, and mechanisms for near term and long term energy storage targets. DOER's initiative on storage is important and recognizes that state governments and agencies, such as Massachusetts and the DOER, must take the lead on environmental and clean and renewable energy issues.

Energy storage needs to be an integral part of the overall solution to provide a stable, reliable energy source that reduces both greenhouse gas emissions and the demand for more natural gas and new natural gas pipelines. Proposals to build new pipelines are based on a perception of peak demand that the Massachusetts Attorney General's report says does not exist and, in any event, can be satisfied by other means. Storage is one of those means. Since storage can be deployed more quickly and flexibly than pipelines to meet peak demand, we suggest it be given priority to displace any such perceived need for pipelines.

Energy storage should not be viewed or deployed as operating in a silo. The 2016 energy bill, H.4568, permits battery storage to be a generation, transmission and distribution asset. Energy Storage has the flexibility to be employed effectively in so many applications: improving utility energy efficiency, stability and grid security; for grid modernization; as emergency back-up power; realizing full use of variable renewable clean energy production facilities such as solar and wind; achieving RPS goals; lowering annual energy costs;, and satisfying GWSA mandates. Moreover, storage can be configured to replace retiring fossil fuel and nuclear generating plants. Given these benefits, any delay in its robust deployment would be irresponsible.

[1] The Sierra Club nationally is the oldest and largest grassroots non-profit and non-partisan environmental organization in the country, with over 1.4 million members and supporters nationwide. The Massachusetts Sierra Club chapter, with its 60,000 members and supporters, has a 40 year history of protecting the environment and is focused on creating a clean and renewable energy economy, combating climate change and reducing the production of green house gases.

The Sierra Club's Initial Comments Focused on Early Deployment of Peaking Facilities: This letter supplements the Sierra Club's December 16, 2016, comments, which responded to the DOER's seven questions.[2] Those earlier comments focused on (1) deploying storage as peaking facilities on the 36.5 MW of existing and currently planned solar and wind distributed energy sites on brownfields that are spread across the state and (2) expanding the use of impaired land sites (closed landfills and fossil fuel and nuclear plants) for more of them.[3] We suggest such sites and uses take best advantage - in the short term - of the acknowledged fact that storage "is the only technology that can use energy generated during low cost off-peak periods to serve load during expensive peak periods, thereby improving the overall utilization and economics of the electric grid." State of Charge (Summary, p. ii, pp. 25, 30). And peaking facilities firm variable energy sources, reduce flicker and provide electricity at a substantially lower cost at peak demand times than currently. State of Charge, pp. 86.-87.

Initial Peaking Facility Goal of 100 MW and Participation in ISO-NE Markets: Since battery storage is in fact capable of relatively quick deployment as evidenced by California's use of it to fill the energy gap caused by the disastrous and massive Aliso Canyon methane storage facility leak,[4] we suggest that the first year goal for installed peaking facilities be at least 100 MW. That will be a significant first step to shave peak demand otherwise proposed to be supplied by natural gas pipelines. We also suggest that it is most useful to deploy peaking facilities so that can participate in ISO NE markets to maximize the benefits of such resources.[5]

Initial Goals for Satisfying Off Peak Daily Load: We suggest an initial goal of 600 MW of deployed storage, including at least 20% in peaking facilities. Part would be mandated for supply by utilities by augmenting their transmission facilities. The rest would be supplied preferably by private, non-utility investment.

Much of the storage is expected to be behind the meter. That capacity should be planned and accounted for as replacement for retiring fossil fuel and nuclear plants and be reflected as well in reduced peak energy demand. As it is likely that behind the meter applications will be made by private investors and companies based on economics and incentives peculiar to them, there may be no need to mandate a target for them.

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[2] The December 16, 2016 submissions are studded with commentary on the benefit and urgency of peaking energy storage facilities. The Sierra Club submission identifies a way down that road now.

[3] "[A]n energy storage asset can be critical in serving the load during the early evening peak hours, eliminating generation from the rarely used peaking generation plants. To obtain maximum system benefits that come from reducing peak capacity the utility must have multiple installations of energy storage distributed across its network instead of a few demonstration projects scattered around the grid, to be used as an aggregated dispatchable asset at peak times." State of Charge, p. 118. The solar and wind facilities existing or planned as of March 2016 on 24 contaminated sites rated for 36.5 MW are already disbursed throughout Massachusetts. See mapped sites. The geographical dispersion of existing brownfield and other impaired land site facilitates siting peaking facilities where most needed.

[4] "Battery Storage Poised to be Deployed rapidly," Scientific American, January 1, 2017. California is slated for over 100 MW of new storage capacity by early 2018 and 1.3 gigawatts of storage by 2020. Id.

[5] "A storage resource can also be dispatched instantly to generate electricity on the grid during a peak period where additional supply is needed, thus replacing the need for natural gas or oil fired peaking generation." State of Charge, p. 9.

Residences, single and multi-family, should also be incentivized to install storage. Residential storage is another behind the meter application that should be planned and accounted for. Its impact will be reflected in reduced peak and off-peak energy demand, depending on time of use.

Siting: A critical factor in deploying storage systems on the other side of the meter is siting, i.e., determining optimal storage locations. Proper siting would avoid unnecessary capital and overhead and maintenance expenditures (1) for sub transmission, substations and feeders, (2) to provide acceptable voltage regulation and power quality, (3) to maintain and enhance distribution reliability and resiliency, and (4) for system and local transmission facilities. It would also permit effective management of renewable energy integration, permit flexible resource allocation and reduce soft or societal costs and enhance public safety.

Co-location of Storage with Existing and Planned Renewable Energy Sites: Co-location of storage facilities with variable renewable sources for both peaking and off peak daily energy needs should be facilitated to harness existing developed sites and reduce interconnection costs.

Supplying Peak Demand with Storage Restrains Natural Gas Pipeline Construction. Massachusetts natural gas has been estimated to supply 60% or more of the state's energy needs. As noted, the Massachusetts Attorney General's report questions the calculation of need for more pipelines as well as the calculation of any shortfall in peak demand energy needs. Notwithstanding, storage is a prime means to satisfy any peak demand.

Storage coupled with solar can be deployed in a far shorter time than the many years it will take to permit and then to build . Even off–shore wind may have a comparable time frame as pipelines, with perhaps some phases being deployed earlier than a pipeline.

Storage batteries are currently rated to have about a ten year life. Unlike an underground multi-billion dollar pipeline with a 30 or more year life and the risk of becoming a stranded asset, batteries can be readily unhooked and replaced with more modern technology. Since storage can be deployed more quickly than pipelines to meet peak demand, we suggest it be given priority to displace any perceived need for more pipelines, which is driven by peak demand.

Fostering Competition Is the Road to Success: Key to success is recognizing that a truly competitive environment is the most efficient way to ensure that energy storage is implemented as cost effectively and quickly as possible. This is not a technology that should be entrusted to an entrenched regulated utility monopoly. Any temptation to do so must be overcome and clear lines of market participation drawn at the outset.[6] Therefore, the Sierra Club recommends that the utilities first to install storage on their own renewable energy sites, and that priority be given to peak saving, peak shifting and cutting peak electricity demand, facilitating energy collection at times of low usage to meet peak demand and improving transmission for distributed renewable

[6] New York State has similarly recognized the value of storage and implemented policies to deploy it in a competitive environment and limit utility ownership directly or through affiliates. Source: New York State of New York Public Service Commission, Case 14-M-0101 - Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision. Order Adopting Regulatory Policy Framework and Implementation Plan. Issued and Effective: February 26, 2015. Pages 68-70.

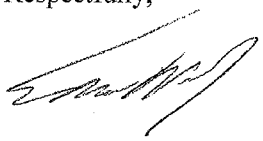
energy sites that have storage. In addition, the utilities may be used to develop and own other sites if and only if there is no feasible private investment alternative.[7]

The Need for Transparency of and Access to Planning Information: One barrier to a competitive environment is lack of access to and lack of transparency to important data. Data regarding grid location and rights of way, timing and fluctuation of energy demand currently and historically, and build-out plans for both generation and transmission facilities needs to be shared. Such information should be made accessible through the DOER and Department of Utility websites. In other words, everyone should have the same basic information to work with. The sharing of such information will foster the best deployment of storage for long term effect and a competitive market.

Massachusetts Should Promote Innovation and Become an International Leader. The 2016 energy legislation established innovation and technology centers for storage and other clean technologies. By doing so, the legislature recognized the capability, competitive advantage and opportunity that Massachusetts has to develop leadership both within the United States and internationally. The Commonwealth's investment in the Wind Technology Testing Center and the New Bedford Marine Commerce Terminal through the Clean Energy Center offers a model for innovation leadership. Incubating local companies' storage technology and innovations, supporting demonstration projects at strategic state facilities / universities and industrial sites and smoothing the way for investment in storage should keep the Commonwealth on the cutting edge of new storage technology development and its management just as we are doing with solar and wind. We can then ensure that Massachusetts will be a global leader in this field also.

The Massachusetts Sierra Club commends the DOER for this effort and looks forward to continue participating in this process.

Respectfully,



Edward Woll, Jr.
Massachusetts Sierra Club
Conservation Chair & Energy Chair

[7] Considerations in New York to manage competing utility and private investment interests include where (1) competitive procurement fails to offer technology options or the options are more costly than utility ownership, (2) energy storage and generation is located on utility property and is directly integrated into distribution service (helping to meet electricity distribution reliability goals), (3) circumstances (including with low and moderate income customers) do not appear to be developing a market for Distributed Energy Resources (DER), (4) system benefits and/or substantial customer benefits can be achieved with DER projects, (5) areas are not being served by markets, and (6) demonstration projects may include third party and utility partnerships. Id.

SUBMITTED ELECTRONICALLY

January 27, 2017

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, Massachusetts 02114
Storage.DOER@massmail.state.ma.us

Re: Comments of Clean Energy States Alliance, Union of Concerned Scientists, and Acadia Center Regarding Policies to Encourage the Cost-Effective Deployment of Energy Storage Systems

Dear Commissioner Judson:

Clean Energy Group (CEG) is pleased to submit the following comments to the Massachusetts Department of Energy Resources (DOER) in round 2 of stakeholder comments in support of its decision to adopt targets for energy storage utility procurement, as per *An Act to Promote Energy Diversity, Chapter 188 of the Acts of 2016 ("Energy Diversity Act").* These comments are also submitted on behalf of Union of Concerned Scientists (UCS) and Acadia Center (AC), who fully join in support of the positions taken here. CEG looks forward to continuing to provide comments throughout this process. CEG, UCS and AC also support the comments expected to be filed by Conservation Law Foundation, Northeast Clean Energy Council, and Boston LISC.

Clean Energy Group is a leading national, nonprofit advocacy organization working on innovative policy, technology, and finance programs in the areas of clean energy and climate change. CEG's Resilient Power Project has been working over the past three years to accelerate market development of clean energy resources paired with energy storage technologies for resilient power applications that serve low-income communities and vulnerable populations during disasters and power disruptions, and to address climate adaptation and mitigation goals through expansion of reliable renewable energy deployment.

The Union of Concerned Scientists, headquartered in Massachusetts, puts rigorous, independent science to work to solve our planet's most pressing problems. On behalf of its more than 500,000 supporters and network of approximately 17,000 scientists—including more than 16,000 supporters in Massachusetts—UCS combines technical analysis and effective advocacy to create practical solutions for a healthy, safe, and sustainable future. This includes working to develop and deploy clean energy policies that lower greenhouse gas emissions, mitigate the worst of climate impacts, and continue to fuel the growth of a renewable energy

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industry that is already creating hundreds of thousands of jobs and driving other local economic benefits nationwide, including in Massachusetts.

Acadia Center is a non-profit, research and advocacy organization committed to advancing the clean energy future. Acadia Center is at the forefront of efforts to build clean, low carbon and consumer friendly economies. Acadia Center's approach is characterized by reliable information, comprehensive advocacy and problem solving through innovation and collaboration.

In order to avoid repetition, CEG summarizes our prior comments, submitted to DOER on December 16, 2016, in the following bullets:

- DOER should establish a utility procurement mandate for energy storage.
- Utility procurement targets should be in the 600 MW – 1.16 GW range (assuming the 600 MW to result from other policies and programs is not counted toward utility targets; if that 600 MW is to be counted, then utility procurement targets should add up to the 1,766 MW identified as optimal in State of Charge).
- Utility ownership should be limited, to encourage the development of a vibrant private sector storage market.
- Sub-targets for behind-the-meter and front-of-meter systems should be established.
- Social benefits should be required from utility-owned storage including LMI benefits, resilience, public health benefits, peaker and baseload displacement, and collocation with renewables.
- An ACP mechanism and fund should be established.
- Complimentary policy mechanisms to support storage deployment should be established.
- DOER should consider a consensus process rather than traditional rulemaking, including workshops to explore rulemaking provisions.

Our comments in this second round fall into the following seven broad categories:

1. Mandatory vs. voluntary target
2. DOER Authority
3. Utility ownership
4. Size and ramping of target
5. Cost-effectiveness of storage
6. Addressing specific utility comments from round 1
7. Process going forward

In addition to our comments below, we attach four other supporting documents, including two California Public Utilities Commission (CPUC) filings documenting issues and approaches used in California, and economic reports on two energy storage projects in Massachusetts (summarized below).

1. Mandatory vs. voluntary target

Now that DOER has decided to establish utility procurement targets for energy storage, the first and most important question to be decided is whether these targets will be mandatory or voluntary ("aspirational"). For a number of reasons, we believe it is important that these targets be mandatory; furthermore, we assert that the enabling legislation supports this view, and that a decision to set voluntary targets would be contrary to a plain reading of the legislation. Finally, we urge Massachusetts to follow the example of the California PUC, which imposed a schedule of mandatory procurement targets based on virtually identical legislative language. These arguments are set forth below.

Mandated utility procurement is necessary to meet Massachusetts' stated goals. Mandated procurement is needed in order to meet the optimized rate of energy storage deployment on the Massachusetts electric grid. The analysis conducted for *State of Charge* report identified this optimal amount of storage as 1,766 MW deployed on the Massachusetts grid by 2020 (resulting in up to $2.3 billion in benefits, plus $250 million in additional regional benefits, and a reduction in GHG gas emissions of more than 1 MMT CO2e over a 10-year time span). However, the suite of policies and programs recommended by the report will only result in 600 MW of new advanced storage by 2025 (providing over $800 million in cost savings to ratepayers and approximately 350,000 metric tons reduction in GHG emissions over a 10 year time span). *Failure to achieve the larger target would leave more than $1.5 billion in economic benefits and 650,000 metric tons of GHG emissions reductions on the table.* And, as noted in the *State of Charge* report, the markets for energy storage are not yet developed to the extent that they could support this target without mandatory utility procurement. Indeed, utility procurement is needed to achieve the maturation of these markets.

The California utility procurement mandate provides an example of how effective mandatory procurement targets are in meeting state energy storage deployment goals. Southern California Edison, for example, in its first round of procurement, contracted more than five times the amount of energy storage it is required to procure under the California mandate.[i] There is no comparable example or study showing that voluntary targets for utility procurement of energy storage would meet the state's goals, or come anywhere close to meeting them.

Without mandates, utilities will not deploy storage at a significant scale. As noted in *State of Charge*, the utilities have filed grid modernization plans identifying energy storage as a "key strategic asset for the future of grid modernization" that will enable numerous benefits including increased deployment of distributed energy resources (DER) with improved reliability and power quality, customer optimization of time varying rates (TVR), distribution system planning and operational improvement, and vehicle-to-grid (V2G) demonstrations. However, as is also noted in *State of Charge*, the actual energy storage deployment proposed by the IOUs in their GMPs is quite small.

For example, Eversource this month filed its Grid Modernization Base Commitment plan,[ii] which includes pilot energy storage projects in four Massachusetts communities, for a total capacity of 29 MW / 128 MWh over the next five years. Clearly, this level of "aspirational" investment will not result in the state meeting even a modest 600 MW goal by 2020 (and the Eversource GMBC plan is not a real commitment to deploy, only a commitment to conduct studies and consider deployment; the four pilots discussed in the plan are based on preliminary analysis and subject to change).

To date, advanced energy storage deployment in Massachusetts amounts to only about 3.5 MW in total (and most of this resulted from a DOER grant under the CCERI program). This points to a disconnect between the acknowledged value of storage, and the reality of investment in a new technology. Mandatory procurement targets would address this by ensuring that utility investment reflects and supports the analysis conducted in State of Charge, and supports the development of markets that will in turn support future private investment.

Without a mandate, private investors will not find a market for storage in MA. In *State of Charge*, DOER identified the central issue that prevents these benefits from being realized through private investment: "Private investors will simply not invest in building storage projects in Massachusetts without a means to be monetarily compensated for the value the storage resource provides to the system, even though doing so would result in cost benefits to ratepayers that substantially outweigh the cost of investment."[iii] In other words, until markets for services provided by storage mature, and market rules are revised to allow storage operators equal access, the many benefits of storage cannot be realized through private investment alone. Setting mandatory utility procurement targets would not only provide for immediate investment and deployment, but would also drive market development and regulatory reform.

The Energy Diversity Act calls for mandatory procurement targets, not voluntary goals. In *An Act to Promote Energy Diversity section 15 (c)*, the Massachusetts state legislature and executive used the following language: "Not later than January 1, 2020, each electric company entity shall submit a report to the department of energy resources demonstrating that it has complied with the energy storage system procurement targets and policies adopted by the department pursuant to this section." The requirement that utilities *demonstrate compliance* indicates that the procurement targets and policies are to be mandatory, not voluntary. If a voluntary goal were contemplated in the legislation, there would be no need to stipulate how utilities should demonstrate that they have complied with the law.

In allowing utility ownership of storage, the Energy Diversity Act implies utility procurement mandates. The *Act to Promote Energy Diversity* addresses energy storage in two important ways: 1) it allows utilities to own storage, which is unprecedented in

the recent history of the Commonwealth; and 2) it instructs DOER to assess, and if appropriate, to establish utility procurement targets for energy storage. Thus the Act assigns to utilities both rights and responsibilities with regard to energy storage – both the right of ownership, and the responsibility to procure. The alternative reading – that utilities now have the right to own storage, but no obligation to develop or deploy it – is an exercise in absurdity. In that case, the only outcome of the Act with regard to energy storage would be to grant utility ownership of the resource, with no attendant requirements or limitations. We do not believe this was the intent of the legislation, and urge DOER to adopt a "rights with responsibilities" reading of the Act.

The lessons of California. When considering whether to interpret the Massachusetts Energy Diversity Act as calling for mandatory energy storage procurement targets, DOER should look to interpretations of similar laws in other states. In particular, it appears that the language used by the Massachusetts legislature in crafting the section of the Energy Diversity Act that addresses energy storage is virtually identical to language used in the California law (AB 2514) [iv] that established a utility mandate to procure energy storage. As can be seen by a comparison of the italicized language in the two laws, the California mandate was obviously used as the basis for the Massachusetts law. In particular:

- Both laws require the energy agency to "*determine whether to set appropriate targets for electric companies to procure viable and cost effective energy storage systems.*"
- In both cases, using identical language, the laws state that the energy agencies "*may consider a variety of policies to encourage the cost-effective deployment of energy storage systems, including the refinement of existing procurement methods to properly value energy storage systems.*"
- Both laws require each utility to submit a report *"demonstrating that it has complied with the energy storage system procurement targets and policies"* adopted by the agency.

In other words, the California PUC, relying on language identical to that employed in Massachusetts, required utilities to achieve a series of specific MW procurement targets by specific dates, stating:

> *The procurement targets set for 2014, 2016, 2018, and 2020 represent the number of MW pending contract, under contract, or installed after the end of those procurement cycles.... By providing this flexibility, the requirements balance the need for energy storage developers to have sufficient lead time to become operational with the IOUs' need to have these systems on-line in a reasonable period of time. Thus, we are balancing flexibility in roughly the next decade with an absolute installation requirement no later than the end of 2024.* [v]

We note that in the California docket, utilities argued that it would be premature to mandate targets. CPUC rejected that argument and imposed mandatory utility targets by utility, stating: "Based on AB 2514, as well as our overall energy policy, we find that it is reasonable to establish procurement targets to encourage the development and deployment of new energy storage technologies." [vi]

To summarize: CPUC faced the same rulemaking question, whether to impose a storage procurement mandate, as is now faced by DOER. It also faced similar objections from utilities. Based on legislative language virtually identical to that used in the MA Energy Diversity Act, CPUC clearly and unequivocally imposed a utility mandate to procure energy storage. That is what the DOER should also do in this case.

For more information on the California energy storage docket, please see attached CPUC filings.

2. DOER Authority

The Energy Diversity Act explicitly empowers DOER not only to establish but to administer an energy storage procurement mandate. This reading is supported by the Act's language: "*the department of energy resources* shall determine whether to set appropriate targets.... *the department* may consider a variety of policies to encourage the cost-effective deployment of energy storage systems.... *The department* shall adopt the procurement targets.... *The department* shall reevaluate the procurement targets not less than once every 3 years.... each electric company entity shall submit a report *to the department of energy resources* demonstrating that it has complied with the energy storage system procurement targets and policies adopted by *the department* pursuant to this section."

In using this language, the Act clearly requires that DOER be the entity that not only adopts the targets, but reevaluates them on a regular basis, and accepts reports from utilities to confirm compliance. Nowhere does the Act contemplate a hand-off of these responsibilities to DPU or any other agency.

Establishment and administration of mandatory targets by DOER would mirror DOER's role in establishing and administration of the Massachusetts RPS and APS. DOER already exercises a regulatory role in administering the state RPS and APS, pursuant to 225 CMR 14.00, 15.00, and 16.00, and is thus well suited for a very similar role in administering a state energy storage portfolio standard.

We also note that the Energy Diversity Act explicitly delegates to DOER the authority to consider "a variety of policies" to fulfill the aims of the section. In so delegating, the legislature adopts an approach comparable to that of the original implementing statute for the state's renewable portfolio standard, under the 1997 restructuring law[vii]. Indeed, the legislature at that time was *less* explicit in some regards about DOER's authority, with no mention of alternative

compliance payments or other mechanisms to ensure the success of the RPS. In that case, DOER rightly exercised its authority in creating and adopting appropriate tools for what was then a nascent policy,[viii] creating a model that many of the states subsequently adopting RPSs (now totaling 29) have drawn from. In the Energy Diversity Act, the legislature clearly expects Massachusetts leadership—including in policy development—via its delegation to DOER.

Furthermore, the three portfolio standards (RPS, APS and energy storage portfolio standard) will be interconnected in practice, since utilities will be procuring both generation and storage, at times from the same resources (in the case of energy storage co-located with renewable or alternative generation behind a single meter). The agency administering the RPS will need to ensure that renewable or alternative energy credits are not double counted when energy generated by an eligible source is stored before being released to the grid. If energy storage is made eligible for the APS, as recommended in *State of Charge*, it may also be necessary to ensure that a single storage resource is not double counted toward both the APS and the energy storage targets. It is therefore both most appropriate and most efficient for DOER to administer utility procurement of all three resource pools – renewable generation, alternative energy resources, and energy storage.

We also note that the administration of programs and policy related to energy storage deployment should be closely coordinated with the administration of utility procurement within the same agency. Energy Diversity Act empowers DOER to use "a variety of policies to encourage the cost-effective deployment of energy storage systems, including the refinement of existing procurement methods to properly value energy storage systems, the use of alternative compliance payments to develop pilot programs and the use of energy efficiency funds." The *State of Charge* report further suggests a suite of complementary policies to support energy storage deployment through grants, incentives, and the inclusion of storage in existing energy programs. These policies and programs should be administered in close coordination with a procurement mandate and targets; it makes no sense to hand off administration of an energy storage procurement mandate to the Massachusetts Department of Public Utilities (DPU) while DOER is administering related policies and programs. For example, state incentives for energy storage deployment need to be calibrated to work in concert with programs and incentives the utilities may develop in order to fulfill their procurement targets. And, the state needs to guard against double-dipping by resources that may qualify for a variety of incentives, including utility incentives under a procurement mandate.

These considerations suggest that the most sensible arrangement is for DOER to administer both policies and procurement mandates as they apply to renewable generation, alternative energy resources, and energy storage. DOER clearly has a legislative mandate to do so.

3. Utility Ownership

Once targets are established, DOER will need to adopt rules regarding the mechanisms for procurement. A key decision will be how much of the procured energy storage capacity may be

owned by utilities, and how much should be owned by third parties or customers. In this we urge DOER to look again to the example of California, which limited utility ownership to 50 percent of the overall procurement targets, and to our prior comments, in which we provided numerous arguments in favor of limiting utility ownership of storage procured under (and counted toward) mandatory targets. Not least of these is the fact that protecting private ownership by restricting utility ownership is necessary to support the development and maturation of the energy storage industry. This approach is also consistent with restructuring.

In this round of comments, we wish to respond in particular to prior utility comments urging DOER to enable "full ownership and/or operation of distributed storage as determined by the distribution company" including visibility and control of distributed storage by EDCs. This comment, and others like it, appear to indicate that utilities feel they must either fully own the energy storage resources (their first choice) or, if they cannot own them, fully control them.

There is no reason that utilities need to have full ownership OR full operational control over storage resources, any more than they need to fully own or control traditional demand response resources or providers of frequency regulation. These services can be provided contractually, with appropriate payment structures and penalties under contract.

In other words, utilities should be able to send a signal to storage operators, to which they respond; utilities do not need, and should not be allowed to demand, full operational control over energy storage resources they do not own. To allow utilities to require either complete ownership or complete control over these resources would have a chilling effect on the energy storage market, and limit the value and usefulness of third party- and customer-owned energy storage resources, which are capable of providing many different services at different times.

We urge DOER to instead require utilities to contractually procure some portion of a mandated target from private resources, and to develop and file standard-offer contracts for the procurement of customer- and third party-owned energy storage services. These contracts should be part of a larger procurement plan each utility should be required to file, outlining how it will reach its procurement targets by the prescribed dates. This will not only provide assurance that targets will be met, but will also send important market signals to storage providers.

4. Size of 2020 target, and ramp-up in out years

CEG supports DOER in its desire to achieve initial success in utility procurement of energy storage systems, and anticipates utility arguments that 2020 is too short a deadline to procure large amounts of energy storage. (Although we note that storage can be deployed and brought online very quickly, as shown by the example of Sterling Municipal Light Department, which bought its 2 MW energy storage system from groundbreaking to full operations in less than three months, and the fast-tracked storage being deployed in California to offset capacity losses

from the imminent retirement of the Diablo Canyon nuclear plant,[ix] and due to the gas shortage resulting from the Aliso Canyon leak.[x])

In order to support both early success and a meaningful target, we suggest a series of procurement targets over the coming years, increasing in non-linear fashion, so that utilities can start with an initial, more achievable (but still mandatory) target, and ramp up to larger mandatory targets in out years.

For an example of how this might look under several different scenarios, we provide the following table. We take as the optimal goal 1,766 MW of new, advanced energy storage on the state grid – the amount identified in State of Charge as providing optimal benefits to the state grid and ratepayers. Because DOER has not yet clarified whether the 600 MW of storage to be achieved through policy and program recommendations from State of Charge would count toward utility targets, we provide suggested numbers for both scenarios, with both shallow and steep ramping options:

Table 1

Proposed Massachusetts Energy Storage Utility Procurement Targets					**Comments**
Target Level	**2020**	**2023**	**2026**	**Total**	
Optimal, inclusive	200 MW	500 MW	1,066 MW	1,766 MW	Assumes 600 MW policy target will be counted toward utility targets
Optimal, inclusive, steeper ramp	125 MW	525 MW	1,116 MW	1,766 MW	Assumes 600 MW policy target will be counted toward utility targets; Provides lower 2020 target with steeper ramp to reach optimal total
Optimal, non-inclusive	150 MW	350 MW	660 MW	1,160 MW	Assumes 600 MW policy target will NOT be counted toward utility targets
Optimal, non-inclusive, steeper ramp	100 MW	375 MW	685 MW	1,160 MW	Assumes 600 MW policy target will NOT be counted toward utility targets; Provides lower 2020 target with steeper ramp to reach optimal total

This ramping approach is similar to the strategy employed in California, as shown in Table 2 below from CPUC:

Table 2

Energy Storage Procurement Targets (in MW)

Storage Grid Domain (Point of Interconnection)	2014	2016	2018	2020	Total
Southern California Edison					
Transmission	50	65	85	110	310
Distribution	30	40	50	65	185
Customer	10	15	25	35	85
Subtotal SCE	90	120	160	210	580
Pacific Gas and Electric					
Transmission	50	65	85	110	310
Distribution	30	40	50	65	185
Customer	10	15	25	35	85
Subtotal PG&E	90	120	160	210	580
San Diego Gas & Electric					
Transmission	10	15	22	33	80
Distribution	7	10	15	23	55
Customer	3	5	8	14	30
Subtotal SDG&E	20	30	45	70	165
Total - all 3 utilities	200	270	365	490	1,325

We note that the targets are all mandatory; that they are additive, not cumulative; that they ramp up progressively; and that they subdivide into transmission, distribution and customer-sited resources. This provides a model that DOER should adopt to meet its energy storage procurement goals.

In particular, we urge DOER to carve out minimum procurement sub-targets for behind-the-meter (BTM) systems, and to consider providing some sort of targeted incentive to help develop these systems in low- to moderate-income communities, which typically are last to benefit from new technologies, but which are most in need of the cost and resiliency benefits of energy storage (see our comments from round 1). We note that GTM Research, in its recent 2016 US Energy Storage Monitor quarterly report, predicts that more than 50 percent of energy storage deployment in the US will be located behind customer meters by 2021. BTM storage provides a wider range of services and is more beneficial to customers than storage placed on the transmission or distribution grid;[xi] Massachusetts should ensure that these benefits are captured through utility procurement targets, and that they are shared in by LMI communities.

5. Cost-effectiveness of storage

The Energy Diversity Act states that DOER should "set appropriate targets for electric companies to procure viable and cost-effective energy storage systems." CEG notes that in prior filed comments, some utilities have asserted that storage is not cost-effective, and that mandatory targets would displace more cost-effective traditional solutions.

We strongly disagree. In fact, energy storage has been shown to be cost-effective in Massachusetts, both behind the meter and on utility distribution systems. We provide here two

examples, and encourage DOER to contact us if more examples, or more economic analysis, is needed.

Two examples of cost-effective energy storage in Massachusetts

CEG believes that, contrary to some utility claims, energy storage can be cost-effectively deployed at various scales and for various applications in Massachusetts, not at some future date, but today. We have worked extensively with developers, utilities, engineering firms, national labs and others to develop rigorous economic analysis of a number of energy storage projects. In many cases we have been able to show how energy storage can pay for itself well within the lifespan of the system, saving money for the owners of these systems while providing benefits for ratepayers and communities.

Here we provide summaries of two such systems in Massachusetts, showing the value streams, costs and payback period for each. More detail is provided in the attached documents.

Boston Housing Authority Example

Through our Resilient Power Project, Clean Energy Group has been working with the Boston Housing Authority (BHA) to assess the feasibility of deploying a combined solar PV and battery storage system at one of their multifamily affordable housing properties. BHA is interested in exploring the combination of solar and storage technologies as both cost-saving measures and as a way to improve the resiliency and safety of the building for its tenants. By designing the system with the ability to island during grid outages, BHA can ensure that critical loads, such as lighting, mobility, communications, and refrigeration, continue to be powered during an emergency.

The storage component of the system is essential to BHA not only due to the resiliency benefits that a solar-only system cannot provide, but also to manage high demand charges. Under its current Eversource electric rate tariff, the affordable housing property faces a summer peak demand charge of nearly $30 per kilowatt. Overall, demand charges account for 36 percent of the building's annual electricity expenditures.

Using an estimated solar array size of 150 kilowatts, the energy software company Geli analyzed 33 months of 15-minute interval electricity usage data to determine economically optimal battery storage system sizing. The analysis found that a 30 kilowatt/45 kilowatt-hour battery system could save BHA around $8,000 per year in demand charges. This size storage system was determined to have an impressive payback period of 4.4 years, more than a year sooner than the estimated payback of the solar system alone.
While a combined solar and storage system appears to be very promising investment opportunity for the public housing authority, the storage portion of the project may be difficult to develop due to a series of existing market failures, such as difficulty in securing project financing due to lack of an extensive track record for storage system technology performance

and return on investment. It is also worth noting that a battery system of this size may be limited in its potential to meet critical power needs during an emergency. The addition of a utility procurement contract for storage capacity would both strengthen the financeability of the project and allow for the economic deployment of a larger storage system, allowing for increased building resiliency and greater safety for affordable housing residents during disasters.

Table 3 - BHA example economics

						Year 1 savings		
	Size	Capital cost	Federal ITC	Depreciation	Net cost	Energy charge	Demand charge	Estimated payback
Solar system	150 kW PV	$375,000	$112,500	$144,713	$117,787	$18,204	$5,374	5.7 years
Energy Storage system	30 kW/45 kWh battery	$88,604	$26,581	$34,192	$27,831	$0	$7,645	4.4 years
Combined system	150 kW PV + 30 kW/45 kWh battery	$463,604	$139,081	$178,905	$145,618	$18,204	$13,019	5.3 years

Sterling Municipal Light Department Example

Through CEG/CESA's work with the Massachusetts CCERI (resiliency) grantees, we have had the opportunity to assist Sterling Municipal Light Department in developing their 2 MW battery storage system in Sterling, MA. The system is deployed on the utility's distribution grid and will provide resilient (backup) power to the town's police station and emergency dispatch center while saving money for the municipal utility by enabling capacity and transmission cost savings along with other revenues.

The system's economics have been the subject of a soon-to-be-published Sandia National Laboratories report (the report is currently under review by IEEE). Value streams for this project, which can be replicated by any utility in New England, are:

Potential revenue for a 1 MW, 1 MWh system:

- Arbitrage savings $13,321.20/year
- Frequency regulation revenues $60,476.04/year
- RNS (transmission cost) savings $98,707.00/year
- FCM (capacity cost) savings $115,572/year (2017-2018 pricing)

Note that the price of transmission and capacity services are increasing, with capacity costs to triple over the next two years.

Given the above revenues and cost savings for a 1 MW project, Sterling's 2 MW project should create cost savings and revenues equivalent to $576,152/yr. Note that this does not include the value of resilient power services to the town's first responders, which is considerable. Nor does it include increases in capacity and transmission service costs over time. And, because the municipal utility is not able to capture federal Investment Tax Credit and accelerated depreciation, this analysis does not include the tax benefits, which would be quite significant if applied (approximately $1 million on a $2.7 million system).

Even without the benefit of federal tax incentives, and without considering the value of resiliency services or increases in capacity and transmission costs, the Sterling system, with a cost basis of $2.7 million, has a simple payback of less than 5 years (this assumes no grants or other subsidies). We expect the actual payback period to be even shorter.

Table 4 - Sterling Municipal Light Department example economics

Energy storage system	Capital cost	Value streams	Revenues/savings per year	Payback period
2 MW / 3.9 MWh lithium-ion battery	$2,700,000	Arbitrage	$26,642	4.68 years
		Frequency Regulation	$120,952	
		Transmission savings	$197,414	
		Capacity savings	$231,144	
		TOTAL	**$576,152**	

We submit these two economic cases to show that, contrary to utility claims, energy storage can be cost effective in Massachusetts today, both behind the customer meter and on the utility system. More detailed economic analysis for the BHA and Sterling cases can be found in the attached documents.

However, as noted in State of Charge, energy storage technologies do not yet have access to all markets in which they could provide services; cannot yet monetize many of their most valuable services; are still overcoming knowledge barriers; and are just beginning to establish a track record of performance.

In other words, there are serious market barriers that need to be overcome through policy measures such as a mandate. For all these reasons storage technologies are still associated with greater investment risk than competing traditional technologies. Therefore, mandates and incentives are important to ensure that utilities will procure storage at a scale that is meaningful within the context of the State of Charge optimization analysis.

6. Addressing utility comments

In our above comments, CEG has addressed a number of utility comments submitted in the previous round, including utility assertions that procurement targets should be "aspirational" and not subject to a compliance mechanism; that storage is not cost effective; and that utilities should have full ownership of energy storage resources or, failing that, full control over them.

In this section we wish to address several additional comments made by utilities in the prior round of stakeholder input:

Retail ratemaking

Utilities have suggested that DOER should allow "retail ratemaking that avoids undue cost-shifting to consumers that do not own storage devices" and adopt "an efficient rate design that compensates solar customers for self-generation and known system benefits, as opposed to maximum energy exports and potential system benefits."

CEG is opposed to setting new fees and tariffs for behind-the-meter solar+storage customers as part of the rulemaking for utility procurement. Such efforts erode the value of solar and storage resources, penalize customers for investing in clean, distributed energy resources, and do not recognize the added value such BTM systems provide to the utility grid.

Instead, DOER should encourage utilities to find ways to capture the added value of these customer-sited systems, for example, through the "virtual power plant" model that has been pioneered by Green Mountain Power in Vermont. This model allows the utility to contract with storage customers to discharge at peak demand hours in response to a signal, much like a demand response program. This aggregated discharge from distributed storage systems can reduce utility capacity and transmission costs that are based on monthly and annual peaks. The resulting savings can be shared with customers. For more information on this system, see http://www.cleanegroup.org/mcknight-lane/.

MW vs MWh

Utilities have suggested that targets should be stated in MW (megawatts). CEG asserts that targets should be stated in MWh (megawatt hours). The use of MW to measure storage capacity is problematic because the MW rating alone is only a power rating; it does not tell you how much energy capacity the battery has, or what applications it is appropriate for. There is a huge difference between a 1 MW battery that discharges over five minutes, and a 1 MW battery that discharges over five hours.

Setting targets in terms of MW alone would allow utilities to comply with the targets by installing systems capable only of brief, intense bursts of power. However, this would not provide most of the system benefits identified in State of Charge, since most of

these benefits require longer, more sustained discharge times. Requiring energy storage capacity to be measured and reported in MWh will provide a much more accurate measure of how much energy storage is actually being provided to the state grid and will allow accurate accounting of utility efforts to meet capacity targets.

Existing assets

Utilities have suggested that existing assets should be counted toward procurement targets. CEG would prefer that only new assets be counted; however, we also recognize that there may be some value to recognizing the efforts of forward-looking utilities that are early adopters of energy storage.

If existing assets are to be counted, we suggest that only relatively recent assets, for example, those installed since 2014, should be eligible (and only if these assets are still in use). This will avoid counting older storage assets that may be approaching end of life, may no longer be in use, or may have declined significantly in operational efficiency. This was the strategy used in California, where storage resources under contract by 2010 were counted toward targets established in 2013.

We also urge that, following the example of California's energy storage mandate, large pumped storage facilities (existing or new) not be counted toward targets for Massachusetts, as their inclusion would crowd out new advanced storage technologies such as batteries and flywheels (and we note that the State of Charge analysis and modeling was based on new advanced energy storage technologies, not pumped hydro, which the reports notes is unlikely to be built in Massachusetts due to geographic and environmental limitations).

APS targets

We note that utilities have suggested that energy storage should count toward APS targets, but that new requirements for storage should not be adopted within the APS. While we are not sure this is the right forum for this debate, we would argue that allowing storage to be eligible within existing procurement programs without setting new targets for storage may detract from procurement of other resources within those programs; alternately, it could result in no storage being procured within those programs. Energy storage and other alternative energy technologies should not be an "either/or" proposition; instead, the state should set out targets for the procurement of storage in tandem with complimentary technologies in these programs.

7. Process going forward

In addition to the above comments, CEG would like to address the process for stakeholder input and rulemaking over the next five months. In particular, we feel that a more structured process for stakeholder input would result in more useful comments and a better forum for sharing information. We suggest that DOER consider something like the following process:

- Divide desired stakeholder input into major topics, such as target size/timing/subdivisions, compliance mechanisms, complimentary policies and mechanisms, utility ownership requirements, and similar issues.
- For each topic area, develop a set of questions and subtopics to be addressed, noting specific issues where technical or analytical input is needed.
- Set a series of dates for the submission of comments in these categories.
- For each category, set a second date for submission of responses to the first round comments.
- Publish comments and responses on the state's website as they are received.

We hope these comments are helpful, and encourage DOER to contact us with any questions.

Sincerely,

Lewis Milford
Clean Energy Group

Todd Olinsky-Paul
Clean Energy Group

John Rogers
UCS

Mike Jacobs
UCS

Paula Garcia
UCS

Peter Shattuck
Acadia

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[i] https://www.greentechmedia.com/articles/read/breaking-sce-announces-winners-of-energy-storage-contracts, http://www.utilitydive.com/news/socal-edison-signs-contracts-for-250-mw-of-energy-storage/329870/

[ii] http://web1.env.state.ma.us/DPU/FileRoomAPI/api/Attachments/Get/?path=17-05%2fESGMBC1.pdf

[iii] State of Charge, xiii

[iv] AB 2514 Section 2836.

(a) (1) *On or before March 1, 2012, the commission shall open a proceeding to determine appropriate targets, if any, for each load-serving entity to procure viable and cost-effective energy storage systems to be achieved by December 31, 2015, and December 31, 2020. As part of this proceeding, the commission may consider a variety of possible policies to encourage the cost-effective deployment of energy storage systems, including refinement of existing procurement methods to properly value energy storage systems.*

(2) The commission shall adopt the procurement targets, if determined to be appropriate pursuant to paragraph (1), by October 1, 2013.

(3) The commission shall reevaluate the determinations made pursuant to this subdivision not less than once every three years.

(4) Nothing in this section prohibits the commission's evaluation and approval of any application for funding or recovery of costs of any ongoing or new development, trialing, and testing of energy storage projects or technologies outside of the proceeding required by this chapter.

(b) (1) On or before March 1, 2012, the governing board of each local publicly owned electric utility shall initiate a process to determine appropriate targets, if any, for the utility to procure viable and cost-effective energy storage systems to be achieved by December 31, 2016, and December 31, 2021. As part of this proceeding, the governing board may consider a variety of possible policies to encourage the cost-effective deployment of energy storage systems, including refinement of existing procurement methods to properly value energy storage systems.

(2) The governing board shall adopt the procurement targets, if determined to be appropriate pursuant to paragraph (1), by October 1, 2014.

(3) The governing board shall reevaluate the determinations made pursuant to this subdivision not less than once every three years.
(4) A local publicly owned electric utility shall report to the Energy Commission regarding the energy storage system procurement targets and policies adopted by the governing board pursuant to paragraph (2), and report any modifications made to those targets as a result of a reevaluation undertaken pursuant to paragraph (3).

[v] Id. At p 26.

[vi] Id at pp. 22-23.

[vii] https://malegislature.gov/Laws/SessionLaws/Acts/2016/Chapter188

[viii] Massachusetts was the first state in the nation to adopt a state-wide renewable portfolio standard.

[ix] https://www.greentechmedia.com/articles/read/pge-to-replace-diablo-canyon-nuclear-plant-with-100-carbon-free-resources

[x] http://www.utilitydive.com/news/inside-construction-of-the-worlds-largest-lithium-ion-battery-storage-faci/431765/, https://www.greentechmedia.com/articles/read/california-utilities-are-fast-tracking-battery-projects-to-manage-aliso-can

[xi] Garrett Fitzgerald, James Mandel, Jesse Morris, Hervé Touati. 2015. The Economics of Battery Energy Storage, Rocky Mountain Institute. http://www.rmi.org/Content/Files/RMI-TheEconomicsOfBatteryEnergyStorage-FullReport-FINAL.pdf

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January 27, 2017

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, Massachusetts 02114

Via electronic mail to: Storage.DOER@massmail.state.ma.us

Re: Conservation Law Foundation's Comments Regarding Scale, Structure and Mechanism of Energy Storage Procurement Targets

Dear Commissioner Judson:

The Conservation Law Foundation ("CLF") is pleased to provide comments to the Massachusetts Department of Energy Resources ("DOER") regarding the scale, structure and mechanism for the mandatory energy storage procurement targets DOER has determined it will set for electric companies under Chapter 188 of the Acts of 2016 (the "Energy Diversity Act"). Our comments build on, and incorporate by reference, our earlier filed comments (dated December 16, 2016), and CLF also strongly supports the January 27 Comments filed jointly by Clean Energy Group, the Union of Concerned Scientists, and Acadia Center.

1. DOER May Establish Mandatory Energy Storage Procurement Targets.

In authorizing DOER to set 2020 energy storage procurement targets for electricity companies if DOER determined such target were appropriate, the Legislature at the same time authorized (if not directed) DOER to set mandatory procurement targets.

Such authorization is visible in the text of the Energy Diversity Act which, in Section 15(a) requires that if such procurement targets are set by DOER, they are "to be achieved" by January 1, 2020.[1] Consistent with that command, the Legislature also expressly required that if DOER were to set targets, each electric company shall demonstrate to DOER by no "later than January 1, 2020" that "it has complied with" them. The most natural reading of those related provisions is to authorize, if not direct,

[1] *See* H.4568 (filed Jul. 31, 2016), lines 725-726.

that any procurement targets DOER decides it is appropriate to set, should also be mandatory:[2] Why else would targets need "to be achieved," and what would it mean to "demonstrate compliance" with a target, if the Legislature intended DOER to establish an optional program that each electric company could in its own discretion choose to ignore?

Such a reading, moreover, is consistent with both the scope of DOER's existing regulatory authority and the Legislature's concurrent grant of new authority regarding mandatory procurements of other another emerging technology that is similarly critical to the Commonwealth's ability to meet its near- and long-term GWSA obligations.

Regarding the former, the Legislature has entrusted DOER with the development, administration, and enforcement of the Renewable Energy Portfolio and Alternative Energy Portfolio Standards (the "RPS" and "APS"). Both regulatory schemes—administered by DOER, pursuant to DOER-issued regulations—set annual mandatory procurement targets on electric companies and other retail electricity sellers. *See* 225 CMR 14.00 – 225 CMR 16.12. Both programs establish mandatory requirements based on audited annual self-reporting to DOER, comparable to that specified in Section 15(c) of the Energy Diversity Act, and are enforced by punitive measures (i.e., among other things, possible license suspension or revocation by the Department of Public Utilities pursuant to 220 CMR 11.07(4)(c)) designed to ensure the achievement of annual compliance. *See* 225 CMR 14.12 (regarding non-compliance with mandatory Class I RPS requirements); 225 CMR 15.12 (same re: mandatory Class II RPS requirements); 225 CMR 16.11 (same re: mandatory APS requirements).

Regarding the latter, Section 12 of the Energy Diversity Act[3] gives DOER an almost exclusive role among state agencies in developing the substance of, and timeline for, the mandatory procurement of up to 1,600MW of offshore wind by 2027, and for determining (with the aid of an "independent evaluator") whether or not proposals received as a result of DOER's procurement solicitation are "reasonable," a threshold determination that, if met, requires electric companies to enter into associated long term contracts[4] which are then subject to approval by the Department of Public Utilities

[2] This reading is supported by the California Public Utilities Commission's ("CPUC's") interpretation of virtually identical authorizing language in California's AB 2514 (2010). In determining that it was reasonable to establish mandatory targets based on its AB 2514 authorization in the context of the state's overall energy policy, the CPUC rejected comments by California utilities, similar to those made a minority of stakeholders in Massachusetts, *see* Comments of Edison Electric Institute (Dec. 16, 2016), at 2-3 (arguing targets should be "voluntary"), Joint Distribution Companies Input to DOER on an Energy Storage Target (Dec. 16, 2016), at 4-5 (arguing targets should be "aspirational"), suggesting that procurement targets should be voluntary. The Energy Diversity Act together with the Commonwealth's overall energy policy—and particularly its GWSA—counsel strongly that DOER should reach the same conclusion.

[3] *See* H.4568 at lines 343-366.

[4] *Id.* at lines 338-39.

("DPU").[5] Such DOER-DPU cooperation is routine,[6] and would be permissible here should DOER determine it appropriate.

2. DOER Should Establish Mandatory Energy Storage Procurement Targets.

CLF vigorously urges DOER to use the authority it has been given to establish mandatory energy procurement targets for Massachusetts electric companies in addition to establishing energy storage incentive programs that DOER determines will help facilitate the timely and cost-effective achievement of such targets.

As CLF (*see* Encl. 1, at 2-3) and others have previously argued there are a host of policy reasons that support the establishment of mandatory, rather than aspirational, procurement targets. Mandatory targets can, in the early years, play an important role in helping the Commonwealth achieve its 2020 GWSA economy-wide emissions cap and will also provide an incentive for the installation of advanced energy storage devices (by requiring such installation) in the absence of well-developed market incentives in New England.

Indeed, the need for mandatory procurement targets, rather than simply new or improved incentive policies, is emphasized by the Commonwealth's experience thus far with the latter alone in the form of DOER's Community Clean Energy Resilience Initiative (CCERI), a $40 million program that can be considered a precursor to the Energy Storage Initiative.

Established in 2014, the CCERI is a commendable and groundbreaking effort meant to provide support to municipal-led resilient power projects to establish islandable systems supporting critical facilities that would be able to provide community and emergency services in the event of a grid outage caused by a natural disaster. Thus far, CLF understands that DOER has awarded approximately $29 million for feasibility studies and implementation grants, the majority of which were for projects that included an energy storage component. These were extremely valuable grants, designed to cover 90% of the cost of eligible technology and engineering costs.

But after three years of such incentives being available, out of eleven municipalities awarded implementation grants for energy storage projects, CLF understands that only one project—the Sterling Municipal Light Department 2 MW energy storage project—has been completed.

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[5] *Id.* at lines 340-41.

[6] For example, DOER could require pre-approval by DPU of any mandatory electric company energy storage procurement as it has done, for example, in the context of the Class I RPS. *See* 225 CMR 14.05(9)(r) (authorizing electric companies to comply with certain RPS requirements by establishing competitive programs if approved by DOER following "prior review and approval by the Massachusetts Department of Public Utilities").

While we support CCERI and the development of additional complementary storage incentive programs, the Commonwealth's recent experience with an incentive-only approach strongly indicates that something more than incentives will be needed to reach the deployment levels anticipated in—and called for by—DOER's *State of Charge* analysis.

3. The Scale and Structure of Mandatory Energy Storage Procurement Targets Should Be Consistent with DOER's *State of Charge* Analysis.

DOER has already conducted a thorough analysis regarding the ability for the state to procure and deploy advanced energy storage between now and 2025, and the benefits such procurement would likely bring. Contained in DOER's *State of Charge* report, that analysis supports the establishment of an aggressive 2020 mandate[7] of at least 150MW[8] (to be allocated among Massachusetts electric companies by their respective share of Commonwealth load),[9] the two year (2018, 2019) pro-rata share of *State of Charge*'s recommendation for the installation of at least 600 MW by 2025.

In doing so, DOER can be confident that the advanced energy storage industry will be able to adequately respond so as to ensure program success. As indicated in Figure 1,[10] the U.S. deployed 226MW of storage in 2015, three and a half times more than had been deployed on average the previous three years, and it is anticipated that the industry is poised to rapidly expand, with

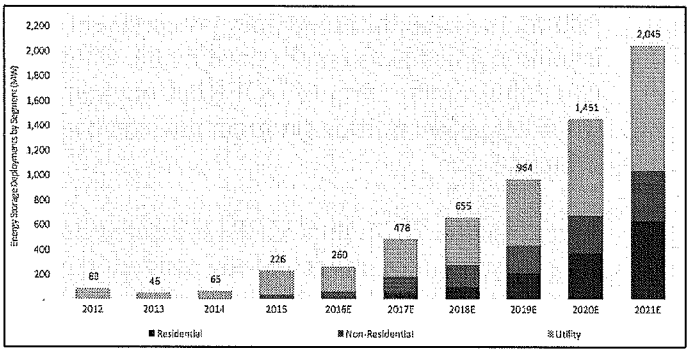

Fig. 1 – *U.S. Annual Energy Storage Deployment Forecast (MW), 2012-2015 (Actual), 2016-2021 (Estimated)*

[7] *See* Comments of CLF (Dec. 16, 2016) ("CLF Comments"), at 3 (citing STATE OF CHARGE at 10, 77).
[8] This comment supersedes that in CLF's previously filed comments (at p.4), correcting it for a January 1, 2020 compliance deadline. CLF encourages DOER to set of mandatory procurement targets designated in megawatt-hours (MWh) at levels consistent with the MW levels indicated here and with the underlying MW-MWh correlation analysis contained in *State of Charge*.
[9] A mandatory target of at least 150MW by Jan. 1, 2020 is further supported by recent public representations by Eversource that it is already pursuing the installation of about 30MW of new energy storage in Massachusetts by about 2021. *See* Eversource, Energy Storage Stakeholder Forum Presentation: *Massachusetts Energy Storage Program* (Westwood, MA) (Dec. 22, 2016), at 5-8. Assuming DOER also adopts required sub-targets for the procurement of distribution-level storage, merchant storage, and "behind the meter" storage sited with consumer end-uses as recommended in *State of Charge* (as CLF has argued it should, *see* CLE Comments at 4), a 150MW state-wide target for 2020 would translate into a similar-sized 2020 requirement (about 35MW) for distribution-level storage for each of the state's largest electric companies.
[10] *Available at*: https://www.greentechmedia.com/research/subscription/u.s.-energy-storage-monitor (last accessed Jan. 25, 2017).

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the ability to support deployments of about 655MW in 2018 and almost 1,000MW in 2019.

Beyond the initial 2020 target, DOER should develop a post-2020 trajectory[11] to require that the full 1,766MW of cost-effective storage identified in *State of Charge* be installed no later than 2030.

Thank you for your consideration of these comments.

Sincerely,

David Ismay
Senior Attorney

Megan Herzog
Staff Attorney

[11] To be re-assessed triennially pursuant to Section 15(b) of the Energy Diversity Act.